þ mechanical section
>>> HI, I'M RON JARNIGIN AND THE PAST CHAIRMAN OF ASHRAE PROJECT COMMITTEE 90.1. WELCOME TO OUR BROADCAST ON ASHRAE/IESNA STANDARD 90.1, 1999. AND THIS PRESENTATION IS MEANT TO GIVE YOU MORE DEPTH, MORE DETAIL AS A FOLLOW-UP TO THE PREVIOUS YEAR'S SATELLITE BROADCAST. IT'S WHAT YOU ASKED FOR, AND SO WE'RE TRYING TO BRING THAT TO YOU. I'D LIKE TO WELCOME OUR NATIONAL AUDIENCE. WELCOME BACK, THOSE OF YOU THAT WERE WITH US FOR THE FIRST SEGMENT. WELCOME FOR THE FIRST TIME TO THOSE WHO MAY BE JOINING US FOR THE FIRST TIME. WE HAVE ABOUT 160 SITES OUT THERE THAT WE'RE AWARE OF. WE'RE CERTAINLY HAPPY TO HAVE YOU HERE. AND ALSO WELCOME TO OUR STUDIO AUDIENCE, WHICH IS PROVIDED BY THE MIDLAND EMPIRE IN SPOKANE, AS WELL AS THEIR INVITED GUESTS. I'D LIKE TO WELCOME OR DISTINGUISHED PRESENTERS. I WILL BE INTRODUCING THE PRESENTER FOR THIS SEGMENT IN JUST A MOMENT. I'D LIKE TO THANK OUR SPONSORS, THE DEPARTMENT OF ENERGY, ASHRAE, AND IESNA FOR HELPING TO MAKE THIS POSSIBLE. IF YOU SEE THE FLYERS, YOU KNOW THE FORMAT FOR THE BROADCAST IS IN THREE SEGMENTS. WE'RE NOW IN THE SECOND SEGMENT. WE'LL BE TALKING ABOUT THE MECHANICAL REQUIREMENTS, AND THERE WILL BE A QUESTION AND ANSWER PERIOD AT THE END OF THIS SEGMENT. AND FAX AND PHONE CALL-IN NUMBERS WILL APPEAR AT THE BOTTOM OF THE SCREEN AND WILL BE PUT UP AS APPROPRIATE. SO WE ENCOURAGE YOU TO CALL IN OR FAX IN THOSE QUESTIONS. THEN, WE'LL BE FOLLOWED BY A 15-MINUTE INTERMISSION AND WE'LL GO TO OUR FINAL SEGMENT. WHILE WE'RE TALKING ABOUT THE '99 STANDARD IN THIS PRESENTATION, I WANT TO MENTION THAT THERE WILL BE A NEW VERSION, THERE IS A NEW VERSION OF THE STANDARD, THE 2001, WHICH INCORPORATES ALL OF THE ADDENDA THAT HAVE BEEN APPROVED. AND THIS HAS BEEN PRODUCED TO GET IN CYCLE WITH THE CODE SEGMENTS AND THE CYCLE FOR CODE ADOPTION. IN FACT, WE HAPPEN TO HAVE A COPY OF THE 2001 STANDARD THAT WAS JUST DELIVERED HERE TODAY, FEDEX FROM ASHRAE HEADQUARTER. IT'S AVAILABLE FOR SALE. IF YOU'D LIKE TO GET A COPY OF THAT, THERE'S A GRAPHIC THAT WILL APPEAR ON YOUR SCREEN THAT WILL TELL YOU HOW TO GET A COPY FROM ASHRAE, AND YOU CAN DO THAT EITHER FROM THEIR WEBSITE OR BY CALLING INTO ASHRAE HEADQUARTERS. AND I WOULD ENCOURAGE YOU TO DO THAT. ONE OF THE QUESTIONS ABOUT THE STANDARD THAT WE'VE GOTTEN IN THE PAST IS, WHERE ARE STATES, IN TERMS OF THEIR ADOPTION, AND HOW DOES THIS HAPPEN? THERE WILL BE A GRAPHIC THAT SHOULD APPEAR ON THE SCREEN THAT GIVES AN INDICATION OF WHERE STATES ARE IN THE PROCESS. PROBABLY A LITTLE DIFFICULT TO READ THE LEGEND ON THIS, BUT THE PURPLE STATES ARE STATES WHICH THEIR STANDARDS HAVE BEEN CERTIFIED TO MEET THE '89 VERSION, MEET OR EXCEED THE '89 VERSION OF THE STANDARD. THOSE ARE IN PURPLE. THE STATES IN RED ARE THOSE THAT CURRENTLY MEET THE '99 STANDARD REQUIREMENTS, MEET OR EXCEED. AND THOSE IN YELLOW ARE IN PROCESS OF ADOPTING AND UPDATING. THOSE IN WHITE HAVE A CHANCE TO CATCH UP WITH ALL THE REST OF THE STATES HERE, SO WE ENCOURAGE THEM TO DO THAT. BY THE WAY, THIS DATA COMES FROM INFORMATION REPORTED TO THE U.S. DEPARTMENT OF ENERGY. SO, IF THERE IS ANY LATE-BREAKING INFORMATION ON THAT, YOU'LL NEED TO MAKE SURE THAT YOU UPDATE YOUR INFORMATION. NOW, WITHOUT FURTHER ADO, I'D LIKE TO MOVE INTO OUR PRESENTATION FOR THIS SEGMENT, AND TRY TO REMEMBER THAT I'M CHANGING THE SLIDES HERE. AND THE PERSON THAT WE HAVE UP IS MICK SCHWEDLER. HE WAS A PAST MEMBER OF THE 90.1 COMMITTEE, AND MICK WAS AN ACTIVE MEMBER OF THE MECHANICAL SUBCOMMITTEE. I'LL TURN IT OVER TO YOU. >> THANK YOU FOR COMING. LET'S LOOK AT THE MECHANICAL STANDARD OF 90.1. THIS SECTION COVERS BOTH HVAC AND SERVICE WATER HEATING. WE'LL SPEND MOST OF OUR TIME ON THE LARGER HVAC SECTION. BEFORE WE GET STARTED, IT'S IMPORTANT TO UNDERSTAND THE REQUIREMENTS IN THE MECHANICAL SECTION WERE SET USING THE SAME ECONOMIC CRITERIA AS THE REST OF THE STANDARDS. IN ADDITION, THE ASHRAE PROCESS ALLOWS PROFESSIONAL JUDGMENT TO BE USED. THE MAKEUP OF

THE MECHANICAL COMMITTEE INCLUDED DESIGN ENGINEERS, CONTRACTORS, MANUFACTURERS, CODE OFFICIALS, AND OTHERS. IN FACT, RON JARNIGIN WAS CHAIR OF THE MECHANICAL SUBCOMMITTEE WHEN I BEGAN WORK WITH THE 90.1 COMMITTEE IN 1994. LET'S MAKE SURE WE UNDERSTAND THE DIFFERENT WAYS WE CAN COMPLY WITH THE HVAC SECTION. WE'LL DISCUSS EACH IN DETAIL, BUT LET'S TAKE A LITTLE TIME HERE TO LOOK AT AN OVERVIEW. FIRST, THERE IS SIMPLIFIED APPROACH. THIS IS MEANT TO REDUCE THE TIME REQUIRED TO COMPLY WITH THE STANDARD ON SMALL BUILDINGS. THEN THERE ARE TWO APPROACHES WITH PARALLEL PATHS. THE FIRST IS TO FOLLOW WHAT I CALL THE COOKBOOK METHOD. IF YOU COMPLY WITH BOTH THE MANDATORY AND THE PRESCRIPTIVE SECTIONS OF THE STANDARD, YOUR DESIGN COMPLIES. MANY OF YOU HAVE LOCAL CODES THAT ARE VERY SIMILAR TO THIS METHOD. THE THIRD COMPLIANCE PATH IS TO COMPLY WITH THE MANDATORY PROVISIONS AND PERFORM AN ENERGY COST BUDGET COMPARISON. SIMPLY PUT, THIS IS A COMPUTERIZED METHOD YOU CAN USE TO SHOW THAT THE ENERGY COST OF YOUR PROPOSED DESIGN IS LESS THAN THAT OF A BUILDING THAT COMPLIES WITH THE STANDARD. THIS GIVES YOU THE FLEXIBILITY TO TRADE OFF REQUIREMENTS IN THE PRESCRIPTIVE SECTION OF THE STANDARD. DURING THIS BROADCAST, WE WILL NOT BE SPENDING TIME ON THE ECB METHOD. NOW, LET'S LOOK AT THE FIRST APPROACH. THE QUESTION POSED WAS, THE HVAC SECTION IS 21 PAGES LONG. IF I'M DESIGNING A SIMPLE SYSTEM FOR A 20,000-SQUARE-FOOT BUILDING, SHOULD I HAVE TO WADE THROUGH 21 PAGES TO DO IT? THE COMMITTEE THOUGHT WE COULD DO BETTER. SO, THE SIMPLIFIED APPROACH WAS INCLUDED SO THAT SMALL BUILDINGS COULD COMPLY WITH THE STANDARD WITH MINIMAL EFFORT, BUT BE SUBJECTED TO THE SAME STRINGENCY AS IN THE REST OF THE STANDARD. WE'LL MOVE QUICKLY THROUGH THE SIMPLIFIED APPROACH AND EXPLAIN SOME OF THE TERMS USED HERE AS WE DISCUSS THE MANDATORY AND PRESCRIPTIVE REQUIREMENTS LATER. THAT'S AN IMPORTANT POINT. THERE IS NO RELAXATION OF STANDARD REQUIREMENTS IN THIS SECTION. THE COMMITTEE SIMPLY LOOKED AT THE REST OF THE HVAC SECTION AND TOOK THE REQUIREMENTS FOR A SMALL BUILDING WITH A SPECIFIC SYSTEM TYPES AND PUT THOSE REQUIREMENTS ON LESS THAN TWO PAGES. THE SIMPLIFIED APPROACH IS RESTRICTED IN SIZE AND USE. THE BUILDING MUST BE TWO STORIES OR LESS, LESS THAN 25,000 SQUARE FEET, AND THE SYSTEM MUST SERVE A SINGLE HVAC ZONE. FOR EXAMPLE, THE FACE OF A BUILDING. YOU MAY STILL HAVE MULTIPLE SYSTEMS IN SUCH A BUILDING, BUT EACH SYSTEM MUST SERVE A SINGLE THERMAL ZONE. MINIMUM EQUIPMENT EFFICIENCY IS A REQUIREMENT. THAT EQUIPMENT MUST ALSO BE EITHER AIR-COOLED OR EVAPORATIVELY COOLED. AN EXAMPLE WOULD BE A SINGLE ZONE ROOFTOP. THE SIMPLIFIED APPROACH THEN DEFINES REQUIREMENTS FOR THESE SYSTEMS. AGAIN, THEY ARE THE SAME STRINGENCY AS THE FULL 21 PAGES OF THE HVAC SECTION. AN ECONOMIZER MAY BE REQUIRED, DEPENDING ON YOUR CLIMATE AND SYSTEM SIZE. HEATING NEEDS TO BE SUPPLIED EITHER BY A FUEL-FIRED FURNACE OR A HEAT PUMP. IN ADDITION, THE MAXIMUM AMOUNT OF OUTSIDE AIR ALLOWED IN THE SYSTEM IS 3,000 CFM, AND IT MUST BE LESS THAN 70% OR HAVE AN ENERGY RECOVERY VENTILATION SYSTEM WITH 50% EFFECTIVENESS. THERMOSTATIC CONTROL MUST BE EITHER MANUAL CHANGEOVER OR DUAL SET POINT. IF A HEAT PUMP IS BEING USED, THE CONTROLS NEED TO MAKE SURE THAT THE FIRST STAGE OF HEAT IS THE HEAT PUMP. ONLY IF THAT HEAT PUMP CAN'T SATISFY THE LOAD IS SUPPLEMENTAL HEATING ALLOWED TO ACTIVATE. ONE OF THE TRADEOFFS WITH USING THE SIMPLIFIED APPROACH IS THAT IT TAKES AWAY SOME OPTIONS. ONE IS THAT YOU MAY NOT USE THIS APPROACH AND USE REHEAT OR ANY OTHER FORM OF SIMULTANEOUS HEATING AND COOLING FOR HUMIDITY CONTROL. THIS IS BECAUSE IN THE PRESCRIPTIVE REQUIREMENTS, THERE ARE LIMITATIONS ON THE AMOUNT OF NEW ENERGY REHEAT ALLOWED TO MAINTAIN HUMIDITY CONTROL. TO KEEP THE SIMPLIFIED APPROACH ON TWO PAGES NECESSITIED ONLY ALLOWING THIS OPTION IN THE PRESCRIPTIVE SECTION. SO YOU CAN STILL DO IT, BUT IT'S IN THE PRESCRIPTIVE SECTION. WITH THE EXCEPTION OF HOTEL AND MOTEL ROOMS,

ONCE SYSTEMS ARE GREATER THAN 65,000 BTU PER HOUR AND 3-4 HP OF FAN POWER, NIGHT SETBACK CONTROLS ARE REQUIRED. PIPING AND DUCTWORK HAS TO BE SLATED AND CONSTRUCTION DOCUMENTS NEED TO BE PREPARED. IN ADDITION, BALANCING MUST BE DONE ON THESE SYSTEMS AND THERMOSTATIC CONTROLS NEED TO BE INTERLOCKED TO KEEP SIMULTANEOUS HEATING AND COOLING FROM OCCURRING. IF THE EXHAUST IS OVER 300 CFM, THE DAMPERS MUST HAVE A POSITIVE MEANS TO ENSURE THEY SHUT, AND ONCE THE SYSTEM IS GREATER THAN 107,000 CFM, OPTIMUM START IS REQUIRED. WE'LL COVER THAT IN MORE DETAIL LATER. REMEMBER, IF YOU WENT THROUGH THE WHOLE STANDARD FOR THIS SYSTEM TYPE, THAT THE REQUIREMENTS WOULD BE THE SAME, IT JUST TAKES LESS TIME ON THE THESE SMALL BUILDINGS. >> THIS LOOKS LIKE A GOOD OPTION FOR THE MANY SMALL BUILDINGS THAT ARE OUT THERE IN THIS COUNTRY, THE SMALL COMMERCIAL BUILDINGS. DO YOU HAVE THE SENSE OF HOW MANY, MAYBE IN ROUGH TERMS, HOW MANY BUILDINGS MIGHT BE ABLE TO FALL INTO THIS APPROACH? >> WELL, YES, RON. WHAT WE DID, WE LOOKED AT, WE GOT A LOT OF INPUT DURING THE PUBLIC REVIEW PROCESS FROM DESIGNERS, FROM MECHANICAL ENGINEERS. WHAT THEY DID, THEY ACTUALLY LOOKED AT IT AND WE DID SOME SURVEYS, LOOKED AT BUILDING ENERGY PERFORMANCE AND BUILDING PERFORMANCE THROUGHOUT THE UNITED STATES AND FOUND THAT ABOUT 80% TO 85% OF THE BUILDINGS IN THE UNITED STATES FELL UNDER THIS CATEGORY. SO IT REALLY MAKES A LOT OF SENSE FOR THE BUILDING DESIGNER. >> AND IT LOOKS LIKE IT BRINGS SIMPLIFICATION TO THE PROCESS, TOO. >> I THINK IT HELPS A LOT, AND TOOK CARE OF THOSE COMMENTS ON A SMALL BUILDING. >> THANKS, MICK. NOW, LET'S STEP THROUGH THE MANDATORY REQUIREMENTS. REMEMBER THAT MANDATORY IS EXACTLY THAT, MANDATORY. IT CANNOT BE TRADED OFF. THE STANDARD'S MANDATORY REQUIREMENTS ADDRESS THE SUBJECTS SHOWN ON YOUR SCREEN. BOTH THE PRESCRIPTIVE AND THE ECB COMPLIANCE PATHS MUST MEET THESE REQUIREMENTS. SHOWN HERE ARE SEVERAL OF THE HVAC EQUIPMENT TYPES WITH MINIMUM REQUIREMENTS IN THE STANDARD. EACH TYPE OF EQUIPMENT LISTED HERE IS COVERED IN A TABLE. IT'S ALSO IMPORTANT TO UNDERSTAND THAT SYSTEMS OF EQUIPMENT THAT ARE NOT LISTED IN THE STANDARDS ACTUALLY HAVE NO REQUIREMENTS. FOR EXAMPLE, TODAY, THERE'S NO TESTING STANDARDS IN PLACE FOR ENGINE-DRIVEN CHILLERS. SINCE THEY ARE NOT RATED AND TESTED, THE COMMITTEE CAN PUT NO REQUIREMENT FOR THEM IN THE STANDARD. THEY MAY STILL BE USED. THAT'S AN IMPORTANT THING FOR YOU TO KNOW. THE EFFICIENCY TABLES SHOWING EQUIPMENT REQUIREMENTS HAVE TWO COLUMNS IN THE STANDARD. ONE COLUMN IDENTIFIES THE LEVELS THAT TOOK EFFECT WHEN THE STANDARD WAS APPROVED TWO YEARS AGO. THE SECOND COLUMN IS THE ONE WE'LL COVER TODAY. THIS COLUMN SHOWS REQUIREMENTS USUALLY MORE STRINGENT, THAT TAKE EFFECT TWO YEARS AFTER THE STANDARD WAS APPROVED. THIS TWO-YEAR TIME FRAME WAS AGREED TO BY CODE OFFICIALS, BUILDING OWNERS, MANUFACTURING REPRESENTATIVES, AND ENVIRONMENTAL GROUPS TO GIVE MANUFACTURERS THE TIME TO REDESIGN EQUIPMENT, RETOOL PLANTS, PRINT NEW LITERATURE, AND GET THE EQUIPMENT READY FOR PUBLIC USE. THE DATE OF STANDARDS APPROVAL WAS OCTOBER 29th, 1999. SO THE NEW EQUIPMENT EFFICIENCY REQUIREMENTS TOOK EFFECT ON OCTOBER 29, 2001. YES, THAT WAS YESTERDAY! TO COMPLY WITH THE STANDARD, EQUIPMENT MANUFACTURED STARTING TODAY MUST MEET THESE NEW EFFICIENCY REQUIREMENTS. ALL THE MAJOR HVAC MANUFACTURERS WERE REPRESENTED ON THE COMMITTEE AND VOTED FOR THE STANDARD. I CAN ALSO ASSURE YOU THAT ALL MANUFACTURERS, INCLUDING THE ONE I HAPPEN TO WORK FOR, HAVE SCRAMBLED ON SOME OF THEIR EQUIPMENT. HOWEVER, SINCE THE EFFICIENCIES DIDN'T CHANGE SINCE THE FIRST PUBLIC REVIEW DRAFT, THERE WEREN'T ANY SURPRISES HERE. IT'S ALSO IMPORTANT TO UNDERSTAND THE CHANGES FROM THE 1989 STANDARD. SEVERAL TYPES OF EQUIPMENT DIDN'T PREVIOUSLY HAVE EFFICIENCY REQUIREMENTS. AS OF YESTERDAY, GROUND SOURCE HEAT PUMPS, ABSORPTION CHILLERS AND HEAT

REJECTION EQUIPMENT SUCH AS COOLING TOWERS HAVE REQUIREMENTS. THERE ARE ALSO NEW CATEGORIES FOR SOME EQUIPMENT SHOWN ON YOUR SCREEN. ONCE AGAIN, THE EFFICIENCY REQUIREMENTS INVOLVED DEVELOPING CONSENSUS WITH ALL THE PEOPLE WHO ARE AFFECTED BY THOSE REQUIREMENTS. FOR EXAMPLE, EXTENSIVE WORK WENT ON WITH THE HEAT REJECTION EQUIPMENT MANUFACTURERS AND ASHRAE'S TECHNICAL COMMITTEE ON COOLING TOWERS TO ENSURE THE EFFICIENCY REQUIREMENTS WERE REASONABLE, YET SAVED ENERGY AND OPERATING COSTS. MOVING ON TO THE EQUIPMENT. FURNACES THAT ARE LARGER THAN 225,000 BTUs PER HOUR NEED TO HAVE INTERMITTENT IGNITION OR INTERRUPTED DEVICE AND EITHER POWER VENTING OR FLUE DAMPER. ALSO, THE JACKET LOSS CAPITAL IS GREATER THAN 0.75% OF THE INPUT RATING. NOW, THE NEXT SLIDE GIVES THREE EXAMPLES OF REQUIRED EQUIPMENT EFFICIENCY. THEY'RE JUST EXAMPLES. THE COLUMN SHOWN HERE IS THE EFFICIENCY REQUIREMENT TWO YEARS FROM THE DATE OF FINAL BOARD APPROVAL. ONCE AGAIN, YESTERDAY. THIS GAVE MANUFACTURERS TIME TO REDESIGN THEIR PRODUCTS AND RETOOL THEIR FACTORIES. NOTE THAT FOR THE CHILLER HERE, THIS FULL LOAD COP EQUATES TO 0.576 kW/TON AS OF OCTOBER 29, 2001. THAT'S AT ARI STANDARD CONDITIONS. THAT'S THE MAXIMUM POWER USE TO COMPLY WITH THE STANDARD. ANOTHER ASPECT TO POINT OUT IS THAT 90.1 IS UNDER A CONTINUOUS MAINTENANCE PROCESS. THAT MEANS THAT CHANGES ARE OCCURRING. ONE SUCH WAS ADDENDUM J. IN LATE 1998, THE ARI CHILLER RATING STANDARD CHANGED, BUT IT WAS TOO LATE TO CHANGE THE ASHRAE STANDARD IN TIME FOR ITS PUBLICATION. SO, IMMEDIATELY AFTER PUBLICATION, THE COMMITTEE ISSUED AN ADDENDUM THAT WENT OUT FOR PUBLIC REVIEW AND INCREASED THE PART LOAD CHILLER REQUIREMENTS. THAT HAS BEEN APPROVED, AND THE INTEGRATED PART LOAD VALUE, OR IPLV, IS NOW 6.40, WHICH EQUATES TO 0.549 kW/TON. IT'S IMPERATIVE TO NOTE THAT IF THERE'S MORE THAN ONE REQUIREMENT, ALL OF THEM MUST BE MET. SELF-CONTAINED UNITS AND CHILLERS MUST MEET BOTH FULL AND PART LOAD REQUIREMENTS AND HEAT PUMPS MUST MEET BOTH COOLING AND HEATING REQUIREMENTS. THERE HAS BEEN SOME CONFUSION OUT IN THE MARKETPLACE WHEN I TALK TO PEOPLE. TO MAKE IT UNDERSTOOD, THESE EQUIPMENT EFFICIENCIES ARE MANDATORY, WHETHER THE PRESCRIPTIVE OR ECB METHOD OF COMPLIANCE IS BEING USED. EQUIPMENT EFFICIENCIES ARE NOT ALLOWED TO BE TRADED OFF AGAINST OTHER BUILDING ASPECTS. MOVING TO OTHER PORTIONS OF THE STANDARD. LOAD CALCULATIONS ARE REQUIRED TO BE PERFORMED USING, AND I'LL QUOTE, GENERALLY ACCEPTED ENGINEERING STANDARDS AND HANDBOOKS ACCEPTABLE TO THE ADOPTING AUTHORITIES, FOR EXAMPLE, ASHRAE HANDBOOK FUNDAMENTALS. IF WE THINK BACK, IN THE 1989 STANDARD, IT ACTUALLY HAD A SIZING RESTRICTION THAT'S NOW REMOVED IN THE 1999 STANDARD. IN MY OPINION, ONE OF THE FURTHER-REACHING CHANGES IN THE STANDARD IS THE INCLUSION OF CONTROLS THROUGHOUT. THIS IS BECAUSE THE COST OF CONTROLS HAS BEEN REDUCED OVER THE LAST 20 YEARS, WHILE THE CAPABILITIES IS NOW INCREASED. THERMOSTATIC CONTROLS ARE REQUIRED FOR EACH ZONE, ALTHOUGH THE PERIMETER CAN BE TREATED DIFFERENTLY. WE'LL LOOK AT THAT ON THE NEXT SLIDE. THIS IS A REQUIREMENT FOR EACH ZONE, NOT EACH ROOM. A ZONE IS OFTEN MADE UP OF A NUMBER OF ROOMS OR SPACES THAT HAVE SIMILAR THERMAL REQUIREMENTS. THERE IS ALSO A REQUIREMENT FOR THE CAPABILITY TO HAVE A 5 DEAD BAND. THAT IS THE DIFFERENCE BETWEEN WHEN COOLING TAKES PLACE AND WHEN HEATING TAKES PLACE. THIS CONTROL CAN BE DONE THROUGH SET POINTS OR USING AN ALGORITHM. THE USER'S MANUAL, AND I DO RECOMMEND YOU GET THAT, GIVE SMS GOOD EXAMPLES OF HOW THE PERIMETER MAY BE ZONED. THE DEFINITIONS CHAPTER ALSO DISCUSSES WHAT CONSTITUTES A ZONE, ESPECIALLY N THE PERIMETER. IN THIS EXAMPLE, AS LONG AS THEY'RE NOT 50 FEET OR MORE OF CONTIGUOUS EXPOSURE IN ONE DIRECTION, A SEPARATE ZONE IS NOT REQUIRED FOR SPACES ON THE RIGHT OF OUR DIAGRAM. THEY CAN BE PUT, ALL BE PUT INTO ONE THERMAL ZONE. NOW, ONCE A SYSTEM

GETS ABOVE 65,000 BTUs PER HOUR, AND THREE-QUARTERS HORSEPOWER OF FAN POWER, MORE REQUIREMENTS KICK IN. FIRST, THE SYSTEM NEEDS TO BE ABLE TO SHUT DOWN AUTOMATICALLY AND SET BACK ITS TEMPERATURE. ONE CONFUSION WE NOTED DURING THE PUBLIC REVIEW PROCESS IS THAT SOME PEOPLE FELT THAT ALL OF THE OFF-HOUR CONTROLS LISTED ON YOUR SLIDE WERE REQUIRED. THE STANDARD STATES THAT AT LEAST ONE OF THE OFF-HOUR CONTROL STRATEGIES LISTED ON THE SLIDE MUST BE AVAILABLE. I CAN SAY THAT SINCE WE'VE STARTED, IT HAS GONE IN, OUR GROUP HAS STARTED TO SEE PEOPLE USE OCCUPANCY SENSORS TO TURN LIGHTS AND SYSTEMS OFF. THEY'VE ACTUALLY BECOME LESS COSTLY AND MORE RELIABLE. NOT A REQUIREMENT, BUT SOMETHING PEOPLE ARE USING. THERE IS AN EXCEPTION FROM THE SETBACK REQUIREMENTS IF YOU USE RADIANT HEATING SYSTEMS BECAUSE THEY CAN'T CATCH UP. OPTIMUM START IS REQUIRED ONCE THE SYSTEM REACHES 10,000 CFM. BASICALLY, OPTIMAL START IS A CONTROL METHOD WHERE THE HEATING AND COOLING SYSTEMS START AS LATE AS POSSIBLE, BUT STILL MEET THE SET POINT BY THE TIME THE SPACE IS OCCUPIED. AS A MINIMUM, THE CONTROL ALGORITHM NEEDS TO BE A FUNCTION OF THE DIFFERENCE THE SPACE SET POINT AND THE AMOUNT OF TIME PRIOR TO THE SCHEDULED OCCUPANCY. ALSO REQUIRED, OUTDOORS AIR SUPPLY AND EXHAUST DAMPERS. AND THEY MUST BE MOTORIZED UNLESS THE OUTSIDE AIR INTAKE OR EXHAUST IS LESS THAN 300 CFM. ANOTHER EXCEPTION FROM THAT IS THAT GRAVITY DAMPERS ARE ALLOWED IF THE BUILDING IS TWO STORIES OR LESS, OR IN ANY HEIGHT BUILDINGS WHERE THE HEATING DEGREE DAYS, THAT'S BASE 65, ARE LESS THAN 2700. FOR EXAMPLE, MILD CLIMATES SUCH AS FLORIDA. DURING OFF-HOURS, THERE NEEDS TO BE THE CAPABILITY TO REDUCE THE AIRFLOW IN A SYSTEM. THIS IS SO THAT THE ENTIRE AIR CONDITIONING SYSTEM DOESN'T HAVE TO FUNCTION TO SATISFY A SMALL AREA OF THE BUILDING. THINK OF IT THIS WAY. NOT MANY OF US GET TO WORK 9:00 TO 5:00 JOBS. PEOPLE ARE IN EARLY, THEY'RE IN LATE OR ON THE WEEKENDS. IF THE ENTIRE SYSTEM HAS TO BE RUN TO SATISFY A SMALL COMFORT LOAD, WELL, THAT'S NOT VERY EFFICIENT. IF THERE'S A LARGE OPEN OFFICE PLAN, THE MAXIMUM ZONE SIZE FOR THIS IS 25,000 SQUARE FEET. A COUPLE TIMES, I'VE BEEN ASKED IF THIS ACTUALLY LIMITS THE SYSTEM SIZE TO 25,000 SQUARE FEET. THE ANSWER IS, ABSOLUTELY NOT. IT SETS JUST AN ISOLATION LIMITATION. THAT PORTION NEEDS TO BE ABLE TO BE SHUT DOWN. SO, AS IT CAN BE SEEN, WE DO NEED TO BE ABLE TO REDUCE AIRFLOW AND BE ABLE TO OPERATE IN A STABLE MANNER AT THESE REDUCED AIRFLOWS. THIS MEANS THAT YOU NEED TO LOOK AT THE PART LOAD CAPABILITIES OF YOUR AIR HANDLING SYSTEM AND MAKE SURE IT'S OPERATING STABLY AT THOSE CONDITIONS. AS IN MOST SECTIONS OF THE STANDARD, THERE ARE EXCEPTIONS. IN THIS ONE, GUEST ROOMS, OR A SYSTEM THAT'S OPERATING 7x24. SOME VERY GOOD EXAMPLES OF ZONE ISOLATION ARE GIVEN IN THE USERS' MANUAL. ISOLATION COULD BE PERFORMED BY USING DIRECT DIGITAL CONTROL, DDC, TO SHUT THE BOXES. NORMALLY CLOSED BOXES THAT USE A POSITIVE METHOD TO CLOSE THEM WHEN POWER TO THE BOX IS REMOVED, PUTTING A MOTORIZED DAMPER AND SUPPLY DUCT OR USING A COMBINATION FIRE/SMOKE DAMPER TO PERFORM THIS ISOLATION. ANOTHER SUBJECT. IF THE HEAT PUMP IS INSTALLED AND IT HAS INTERNAL ELECTRIC HEATERS, THE FIRST SOURCE OF HEAT MUST BE THE HEAT PUMP, RATHER THAN THE ELECTRIC RESISTANCE HEAT. THIS IS BECAUSE THE COP OF A HEAT PUMP CAN BE IN A RANGE OF THREE OR HIGHER WHERE THE ELECTRIC RESISTANCE HEAT HAS A COP OF ONE. THERE IS AN EXCEPTION FOR NAECA EQUIPMENT AND WHERE THE RATING ALREADY INCLUDES THE ELECTRIC RESISTANCE HEATING. OBVIOUSLY, ONCE THIS SYSTEM SIZE AND POWER CRITERIA WE TALKED ABOUT ARE MET, THERE ARE UNIT AND SYSTEM LEVEL CONTROLS THAT WILL BE REQUIRED TO MEET THESE MANDATORY CONTROL REQUIREMENTS. THERE ARE ALSO SPECIFIC REQUIREMENTS FOR INSULATION. ON YOUR SCREEN IT SAYS "DURABLE." YOU WON'T FIND THE WORD "DURABLE" IN THE STANDARD. THAT'S MY WORD. BUT BASICALLY THE INSULATION NEEDS TO BE ABLE TO WITHSTAND ITS ENVIRONMENT. IF IT'S OUTSIDE, IT MUST HOLD

UP TO THE SUN, THE WIND, THE RAIN AND ET CETERA. THERE ARE ALSO SYSTEMS SEALING LEVELS INCLUDED IN THE STANDARD. THESE CONTINUE TO BE A SUBJECT OF DISCUSSION AND THE COMMITTEE USES THE CONTINUOUS MAINTENANCE PROCESS TO FURTHER REFINE THE NEW STANDARD AS NEW SEALING TECHNIQUES AND INFORMATION COMES TO LIGHT. THE USERS' MANUAL HAS A GREAT EXAMPLE OF WHERE INSULATION MUST BE APPLIED IN VARIOUS SYSTEMS. IT SHOWS 14 DIFFERENT LOCATIONS WHERE THE DUCT TYPE, SUCH AS RETURN OR SUPPLY, AND LOCATION MAY BE, IN A VENTED ATTIC, OUTDOORS, ON THE GROUND, ET CETERA. THE AMOUNT OF INSULATION VARIES DEPENDING ON THE DUCT LOCATION AND THE CLIMATE IN, WHICH THE BUILDING IS LOCATED. THE USERS' MANUAL ALSO DISCUSSES THE THICKNESS OF INSULATION AND TYPICAL R-VALUES GIVEN BY THAT INSULATION. LEAKAGE TESTS ARE REQUIRED ON DUCT SYSTEMS WHERE THE STATIC PRESSURE IS INTENDED TO OPERATE IN EXCESS OF THREE INCHES OF WATER COLUMN. THOSE LEAKAGE TESTS ARE REQUIRED ON 25% OF THE DUCTS OPERATING ABOVE THREE INCHES. THIS IS LIKELY TO LEAD DESIGN ENGINEERS TO REDUCE DUCT STATIC PRESSURE, WHICH, IN TURN, REDUCES FAN POWER AND THE ENERGY CONSUMPTION. NOW, THERE ARE ALSO PIPING INSULATION REQUIREMENTS. AGAIN, THESE WERE DEVELOPED BASED ON THE LIFE CYCLE COSTING. HERE'S ONE OF THE QUESTIONS I USUALLY GET WHEN I GIVE A PRESENTATION ON 90.1. IS THERE ANYTHING IN THE STANDARD THAT IS LESS STRINGENT THAN THE 1989 STANDARD? AND THE ANSWER IS, YES. SINCE ECONOMIC CRITERIA WERE USED THROUGHOUT THE NEW STANDARD, SOME PIPING INSULATION REQUIREMENTS ARE LOWER THAN THE ASHRAE 90.1, 1989. NOW, THERE ARE ALSO EXCEPTIONS FOR INSULATION DEPENDING ON WHERE IT'S INSTALLED AND THE FLUID TEMPERATURES. ANOTHER REQUIREMENT IN THE STANDARD IS THAT THE DESIGN TEAM'S KNOWLEDGE AND INTENT MUST BE PASSED TO THE BUILDING OWNER. I'D SAY THAT IN OUR PAST, OUR INDUSTRY DIDN'T ALWAYS DO A VERY GOOD JOB OF TRANSFERRING THIS KNOWLEDGE TO THE BUILDING OWNER. IF YOU THINK ABOUT IT, IF THE OPERATOR DOESN'T KNOW HOW A SYSTEM IS SUPPOSED TO OPERATE, WHAT IS THE CHANCE THAT THE SYSTEM WILL OPERATE EFFICIENTLY? PROBABLY PRETTY CLOSE TO ZERO. SO, DRAWINGS, MANUALS, AND A NARRATIVE OF THE INTENDED SYSTEM OPERATION ARE REQUIRED TO BE TURNED OVER WITHIN 90 DAYS OF CONSTRUCTION. THIS MEANS MANUFACTURERS HAVE TO SHIP MANUALS WHEN THE EQUIPMENT IS SHIPPED AND THE DOCUMENTATION NEEDS TO GET TO THE BUILDING OWNER. IN ADDITION, THE MAINTENANCE MANUAL NEEDS TO SPECIFY AT LEAST ONE QUALIFIED SERVICING AGENCY AND THEIR ADDRESS. THERE ARE ALSO BALANCING REQUIREMENTS THAT ARE MANDATORY ONCE CERTAIN THRESHOLDS ARE REACHED. BALANCING IS REQUIRED ONCE THE CONDITIONED SPACE IS GREATER THAN 5,000 SQUARE FEET, AND NEEDS TO BE IN ACCORDANCE WITH INDUSTRY-ACCEPTED PRACTICES. APPENDIX E GIVES A REFERENCE TO BALANCING PROCEDURES. THE BALANCING REQUIREMENTS TAKE EFFECT IF THE AIRSIDE IS GREATER THAN ONE HORSEPOWER OR THE WATER SIDE IS GREATER THAN 10 HORSEPOWER. THE STANDARD REQUIRES HYDRONIC SYSTEMS TO FIRST BE BALANCED TO MINIMIZE THROTTLING LOSSES, AND THEN TRIM THE IMPELLER OR ADJUSTING THE PUMP SPEED. A PRESSURE DIFFERENTIAL SENSOR ACROSS THE PUMP OR TEST PORTS ARE ALSO REQUIRED. THE FINAL MANDATORY REQUIREMENT WE'LL ADDRESS TODAY IS COMMISSIONING. COMMISSIONING AS USED HERE IS TO MAKE SURE THE CONTROL ELEMENTS ARE CALIBRATED, ADJUSTED, AND WORKING PROPERLY. IT IS REQUIRED ONCE THE AREA IS GREATER THAN 50,000 SQUARE FEET, AND THE STANDARD STATES THAT IT IS THE DESIGNER'S RESPONSIBILITY TO PROVIDE DETAILED INSTRUCTIONS. NOW, THAT WAY, YOU, THE DESIGN ENGINEER, CAN DOCUMENT THE AMOUNT OF COMMISSIONING WARRANTED FOR THIS SPECIFIC JOB. INFORMATION IN APPENDIX E CITES ASHRAE GUIDELINE ONE AS ONE POSSIBLE SOURCE OF COMMISSIONING INFORMATION. >> MICK, A COUPLE OF THINGS HERE. ONE, YOU'VE GOT THROUGH THE MANDATORY SECTION, AND I THINK IT WOULD BE GOOD FOR OUR LISTENERS TO REALIZE THAT MANDATORY MEANS JUST THAT. >> THAT'S EXACTLY RIGHT, RON. >> I WONDER IF

YOU COULD BRIEFLY RECAP THE HIGH POINTS IN THAT, THE MANDATORY REQUIREMENTS. >> SURE. I GUESS THE MANDATORY REQUIREMENTS, THE THINGS THAT I THINK ABOUT ARE, FIRST OF ALL EQUIPMENT EFFICIENCIES. THAT'S PRETTY SIMPLE BECAUSE THAT'S ON THE NAMEPLATE. NEXT, YOU HAVE THE CONTROL REQUIREMENTS, THAT'S A LARGE CHANGE FROM IN THE PAST. THE CONTROL REQUIREMENTS HAVE INCREASED QUITE A BIT. WE HAVE CONSTRUCTION AND INSULATION. WE HAVE THE DOCUMENTATION GETTING TO THE BUILDING OWNER, AND WE ALSO HAVE THE COMMISSIONING THAT'S REQUIRED. SO, THOSE ARE THE MANDATORY REQUIREMENTS. >> OKAY, GREAT. THANKS, MICK. >>> NOW, IF YOU DECIDE TO USE THE PRESCRIPTIVE PATH, ALL PRESCRIPTIVE REQUIREMENTS MUST BE MET. HERE'S A THUMBNAIL SKETCH OF WHAT'S ENTAILED. IT REQUIRES ECONOMIZERS IN SPECIFIED CLIMATES. IT LIMITS HOW MUCH SIMULTANEOUS HEATING AND COOLING CAN BE DONE. IT HAS AIRSIDE DESIGN AND CONTROL REQUIREMENTS. PROVIDES SPECIFICATIONS FOR HYDRONIC SYSTEM DESIGN AND CONTROL. LISTS HEAT REJECTION REQUIREMENTS. IT ALSO STATES HEAT RECOVERY REQUIREMENTS FOR SYSTEMS WITH LARGE AMOUNTS OF OUTDOOR AIR OR SIMULTANEOUS HEATING AND COOLING. AND IT HAS EXHAUST HOOD REQUIREMENTS. NOW, LET'S TAKE A LOOK AT EACH OF THESE INDIVIDUALLY. ECONOMIZERS ARE NOT REQUIRED IN ALL CLIMATES. IN FACT, THE REQUIREMENT IS BOTH SIZE AND CLIMATE DEPENDENT. THERE ARE ALSO NUMEROUS EXCEPTIONS INCLUDING SYSTEMS WITH CONDENSER HEAT RECOVERY, SYSTEMS THAT OPERATE LESS THAN 20 HOURS PER WEEK. FOR EXAMPLE, A HOUSE OF WORSHIP, SUPERMARKET SYSTEMS. AND, WHERE THE EQUIPMENT EFFICIENCY HAS BEEN INCREASED TO THE LEVEL SPECIFIED IN THE STANDARD. FOR EXAMPLE, IN ONE CASE, IF A ROOFTOP EFFICIENCY CHANGES FROM 10.3 TO 12.5 EER, NO ECONOMIZER IS REQUIRED. IT'S ALSO IMPORTANT TO UNDERSTAND THAT THE ECONOMIZERS CONTROLS NEED TO BE INTEGRATED. THAT MEANS THAT THE ECONOMIZER NEEDS TO BE CAPABLE OF PROVIDING PARTIAL COOLING EVEN WHEN ADDITIONAL MECHANICAL COOLING IS REQUIRED. AN AIRSIDE ECONOMIZER HAS A HIGH LIMIT SHUTOFF POINT THAT IS CLIMATE-DEPENDENT. IN DRY CLIMATES, THIS POINT IS 75 DEGREES, AND IN HUMID CLIMATES, IT'S 65 DEGREES FAHRENHEIT. AT THIS POINT, THE OUTSIDE AIR MUST BE REDUCED TO ONLY THAT AMOUNT REQUIRED FOR VENTILATION. THE CONTROL TYPES ALLOWED VARY, DEPENDING IF IT'S A HUMID, GREATER THAN 73 DEGREE WET BULB, INTERMEDIATE, 69 TO 73, OR A DRY CLIMATE. IN DRY CLIMATES, FIXED ENTHALPY IS BASICALLY NOT ALLOWED, AND IN HUMID CLIMATES DIFFERENTIAL DRY BULB CONTROL IS NOT ALLOWED. THERE'S ALSO A MAXIMUM LEAKAGE RATE ALLOWED FOR THE RETURN AND OUTSIDE AIR DAMPERS. ALSO, ATTEMPTING TO BRING IN MORE OUTSIDE AIR THAN DURING DESIGN REQUIRES A WAY TO RELIEVE THE PRESSURE FROM THE BUILDING. SO, THE DESIGN ENGINEER NEEDS TO THINK ABOUT HOW HE OR SHE CAN PREVENT OVER PRESSURIZATION. AS ALWAYS, YOU NEED TO AVOID RE-CIRCULATION OF THE RELIEF AIR BACK INTO THE BUILDING. NOW, IF A WATERSIDE ECONOMIZER IS INSTALLED, IT MUST BE ABLE TO MEET THE LOADS WHEN THE AMBIENT CONDITIONS ARE 5 DEGREES DRY BULB AND 45 DEGREES WET BULB. IN CASES WHERE DEHUMIDIFICATION REQUIREMENTS CAN'T BE MET WITH THE ECONOMIZER, THE AMBIENT CONDITIONS COULD BE SET TO 45 DEGREES DRY BULB AND 40 DEGREES WET BULB. IF THE WATERSIDE COIL PRESSURE DROP IS GREATER THAN OR EQUAL TO 15 FEET, THE ECONOMIZER MUST BE BYPASSED WHEN IT'S NOT BEING USED. MOST PACKAGED ECONOMIZERS ARE ALREADY BUILT THIS WAY. FOR ALL ECONOMIZERS, THERE IS A REQUIREMENT TO NOT INCREASE THE HEATING ENERGY IN THE SYSTEM. IN EFFECT, THIS DISALLOWS SYSTEMS SUCH AS SIMPLE-FAN, DOUBLE-DUCT SYSTEMS, SINCE THEY GREATLY INCREASE THE HEATING ENERGY USAGE. THE USERS' MANUAL GIVES AN EXAMPLE OF THE ECONOMIZER IN THE SIDE STREAM OR SERIES LOCATION. A DEPICTION IS SHOWN ON YOUR SCREEN. THIS SATISFIES THE REQUIREMENT FOR THE ECONOMIZER CONTROL TO BE INTEGRATED. IF THE PLATE AND FRAME HEAT EXCHANGER IS PIPED IN THIS SIDE STREAM POSITION, IT CAN BE USED FOR MORE

HOURS IN THE YEAR BECAUSE IT DOES NOT NEED TO MAINTAIN A LEAVING CHILLED-WATER SET POINT OF THE SYSTEM. IT CAN PROVIDE SOME USEFUL COOLING AT ANY TIME THAT IT CAN PRE-COOL THE SYSTEM RETURN WATER. THIS ALLOWS THE ECONOMIZER TO OPERATE MANY MORE HOURS DURING THE YEAR, AND REDUCE THE COST OF COOLING THE BUILDING. IT BECOMES MORE EFFECTIVE AS A HEAT EXCHANGER IN THIS POSITION. NOW, LET'S LOOK AT HOW CLIMATE AND SIZE ARE USED TO DETERMINE WHETHER OR NOT AN ECONOMIZER IS REQUIRED. LET'S ASSUME FOR A SECOND THAT I'M IN SPOKANE, WASHINGTON. HEY, THAT IS WHERE WE ARE TODAY! LOOKING IN APPENDIX D OF THE STANDARD AND THE ASHRAE HANDBOOK, I FIND THAT THE 1% DESIGN WET BULB IS 65 DEGREES, AND THE NUMBER OF HOURS BETWEEN 8:00 A.M. AND 4:00 P.M. WITH THE TEMPERATURE BETWEEN 55 AND 69 DEGREES IS 640. LOOKING AT THIS CHART, I'M REQUIRED TO HAVE AN ECONOMIZER ONCE THE SYSTEM SIZE IS ABOVE 65,000 BTU PER HOUR, ABOUT 5.4 TONS. THERE ARE SOME LOCATIONS WHERE NO ECONOMIZER IS REQUIRED. USING THIS TABLE AND THE WEATHER DATA AVAILABLE IN APPENDIX D, HERE ARE SOME EXAMPLES. AS YOU CAN SEE, ECONOMIZERS ARE GENERALLY NOT REQUIRED WHERE THEY DON'T MAKE SENSE, HUMID CLIMATES OR THOSE THAT HAVE FEW OPERATING HOURS, SUCH AS MIAMI. ON THE OTHER HAND, DRY CLIMATES, LIKE DENVER, WITH MANY OPERATING HOURS, SHOULD REALLY HAVE ECONOMIZERS ANYWAY. AND THEY'RE REQUIRED. ONE THING TO POINT OUT IS THAT YOUR PROFESSIONAL JUDGMENT ALWAYS ALLOWS YOU TO DESIGN AN ECONOMIZER INTO A SYSTEM, EVEN IF IT ISN'T REQUIRED BY THE STANDARD. THE STANDARD IS ONLY THE MINIMUM REQUIREMENT. MOVING ON FROM ECONOMIZERS, THERE ARE LIMITS ON SIMULTANEOUS HEATING AND COOLING. THIS IS PROBABLY ONE OF THE MORE SIGNIFICANT CHANGES IN THE 1999 STANDARD. THE DEFINITION OF SIMULTANEOUS HEATING AND COOLING INCLUDES PREVENTING FIRST, REHEATING, RE-COOLING, AND ALSO PREVENTING MIXING OR SIMULTANEOUSLY SUPPLYING AIR THAT HAS BEEN PREVIOUSLY MECHANICALLY HEATED OR COOLED, OR COOLED BY AN ECONOMIZER. NOTE THAT REHEATING OR RE-COOLING, IN THE CASE OF A DESICCANT SYSTEM, ARE NOT BANNED. THEY'RE JUST LIMITED. THERE ARE ALSO EXCEPTIONS BASED ON THE ZONE AIRFLOW. THE STANDARD NOW PROHIBITS THREE PIPE HYDRONIC SYSTEMS. THAT IS, ONE COOLING PIPE, ONE HEATING PIPE, AND A COMMON RETURN PIPE. WE DON'T SEE THAT MUCH ANYMORE. ALSO, IF A TWO-PIPE SYSTEM, SUCH AS A FAN COIL SYSTEM IS INSTALLED, THERE'S A REQUIREMENT FOR AT LEAST A 15 DEGREE DEAD BAND BETWEEN CHANGEOVER FROM ONE MODE AND THE OTHER, AND AT LEAST FOUR HOURS BEFORE GOING FROM ONE MODE TO THE OTHER. HEAT PUMP SYSTEMS NEED TO HAVE TWO POSITION VALVES WHEN THE PUMP POWER IS GREATER THAN 10 HORSEPOWER. THIS IS SO THAT THE SYSTEM PUMPING POWER CAN BE REDUCED WHEN THE HEAT PUMP CYCLES OFF. NOW, BEFORE REHEATING OR RE-COOLING CAN BE PERFORMED, THE SUPPLY AIRFLOW IN THE ZONES NEEDS TO BE REDUCED TO THE LARGEST OF THE QUANTITIES SHOWN ON YOUR SCREEN. THE TWO THAT WILL PROBABLY BE MOST USED ARE THE ASHRAE STANDARD 62 VENTILATION REQUIREMENTS, OR THE 0.4 CFM PER SQUARE FOOT. IN MOST VARIABLE AIR VOLUME SYSTEMS, THIS WILL ALLOW THE REHEAT MINIMUM TO BE SET, AND NEW ENERGY REHEAT TO BE USED. HOWEVER, IF THE AIRFLOW CANNOT BE REDUCED TO THE AMOUNTS SHOWN, THEN THE HEATING CAN BE DONE, BUT AT LEAST 75% OF THE REHEAT ENERGY NEEDS TO BE EITHER SITE RECOVERED OR SITE SOLAR. IN ADDITION, SPACES WITH SPECIAL PRESSURIZATION REQUIREMENTS OR CROSS CONTAMINATION ARE EXEMPTED FROM THE SIMULTANEOUS HEATING AND COOLING LIMITATION. AN EXAMPLE IS AN OPERATING ROOM. IF YOU'RE APPLYING AN ACTIVE DESICCANT SYSTEM, YOU NEED TO UNDERSTAND THE AMOUNT OF RE-COOLING ENERGY IS ALSO LIMITED. ONCE HUMID STATIC CONTROLS ARE BEING USED, THE AMOUNT OF SIMULTANEOUS HEATING AND COOLING IS ALSO LIMITED. AS IN THE NORMAL REHEAT FOR COMFORT, THERE ARE A NUMBER OF EXCEPTIONS. HERE THEY ARE. THE AMOUNT OF COOLING BEING DONE NEEDS TO BE REDUCED PRIOR TO REHEAT. ONE WAY OF DOING THIS IS TO REDUCE THE SUPPLY AIRFLOW TO 50% OF

DESIGN OR MINIMUM VENTILATION. ANOTHER IS TO HAVE A FAIRLY SMALL SYSTEM, JUST UNDER SEVEN TONS, THAT CAN UNLOAD BY AT LEAST 50% PRIOR TO REHEAT. IF THE SYSTEM IS SMALL, UNDER 3.3 TONS, NEW ENERGY REHEAT CAN BE USED AT ANY TIME. THE PROCESS APPLICATIONS EXCEPTIONS INCLUDES COMPUTER ROOMS, MUSEUMS, SURGICAL SUITES, ICE ARENAS, ET CETERA. AGAIN, AN EXCEPTION IS THAT IF 75% OF THE REHEAT ENERGY IS SITE RECOVERED, YOU MAY DO ALL THE REHEAT YOU WISH. LET ME STEP FROM JUST TALKING ABOUT THE STANDARDS REQUIREMENTS AND PUT MY ENGINEER'S HAT ON FOR A SECOND. ON VAV SYSTEMS, THE HUMIDITY IS CONTROLLED, SINCE WE HAVE A CONSTANT SUPPLY AIR TEMPERATURE. AS LONG AS OUR REHEAT MINIMUMS ARE PROPERLY DESIGNED COMPLYING WITH THIS SIMULTANEOUS HEATING AND COOLING REQUIREMENT SHOULDN'T BE TOO HARD. HOWEVER, THE LIMITATIONS PUT ON SIMULTANEOUS HEATING AND COOLING WILL BE PRETTY TOUGH TO MEET WITH CONSTANT VOLUME SYSTEMS. I CAN'T TURN DOWN MY AIRFLOW. IF I BACK OFF ON CAPACITY, I CAN'T ACTIVELY DEHUMIDIFY THE AIR. WHILE NOT A PORTION OF THE STANDARDS, IT'S LIKELY THAT THE LIMITATIONS ON SIMULTANEOUS HEATING AND COOLING JUST DISCUSSED WILL LIKELY LEAD TO MORE DESIGNS THAT EITHER USE HOT-GAS REHEAT, IN THE CASE OF A DX SYSTEM, OR HEAT RECOVERED FROM A CHILLER'S CONDENSER TO SATISFY THE REHEAT OR THE TEMPERING LOADS. REMEMBER THAT AT TIMES OF TEMPERING, GENERALLY THE REQUIRED WATER TEMPERATURE CAN BE REDUCED, PERHAPS TO 100 TO 105 DEGREES FAHRENHEIT. AND THE LOAD CAN BE MET WITH CONDENSER WATER FROM A CHILLER. SHOWN ON YOUR SCREEN IS ONE METHOD OF PIPING A CHILLER INTO A SYSTEM SO THAT IT CAN BE PREFERENTIALLY LOADED TO PROVIDE AS MUCH RECOVERED HEAT AS POSSIBLE. THE CHILLER SEES THE WARMEST RETURN WATER TEMPERATURE FROM OUR SYSTEM, SO IT CAN BE LOADED EASILY. WHEN THE CHILLER'S PUMP IS ACTIVATED, THE CHILLER CAN BE LOADED AS MUCH OR AS LITTLE AS NECESSARY, SIMPLY BY CHANGING ITS CHILLED WATER SET POINT. THIS WAY, THE AMOUNT OF HEAT REQUIRED CAN ACTUALLY BE MATCHED BY THE CHILLER. BOTTOM LINE IS THAT A LOT OF DESIGN ENGINEERS THINK WE'LL START TO SEE MORE HEAT RECOVERY IN SYSTEM DESIGNS. IF HUMIDIFICATION IS BEING PERFORMED TO KEEP THE BUILDING DEW POINT AT OR ABOVE 30 DEGREES F, AND THERE IS AN ECONOMIZER REQUIRED, A WATER ECONOMIZER MUST BE USED. THIS IS BECAUSE THE USE OF AN AIR ECONOMIZER IN WINTER CAN GREATLY REDUCE THE DEW POINT IN A SPACE. IF THAT DEW POINT IS REDUCED, THE AMOUNT OF ENERGY PUT BACK INTO THE HUMIDIFICATION PROCESS IS EXTREMELY HIGH. USING A WATER ECONOMIZER AVOIDS THIS PROBLEM. LET'S MOVE ON TO AIR SYSTEM DESIGN AND CONTROL. ONCE THE SYSTEM FAN POWER REACHES FIVE HORSEPOWER, A NUMBER OF REQUIREMENTS GO INTO EFFECT. A DISTINCT CHANGE BETWEEN THE 1989 AND THE 1999 REQUIREMENTS IS THAT THE FAN POWER LIMITATION IS NOW BASED ON NAMEPLATE HORSEPOWER. THIS IS SO THAT CODE OFFICIALS CAN EASILY CHECK THE MOTOR POWER LISTED ON THE DRAWING AGAINST WHAT IS ACTUALLY INSTALLED IN THE BUILDING. IT'S OBVIOUS THAT THE POWER ACTUALLY USED BY THE FAN IS LESS THAN THE NAMEPLATE POWER, SO THE ALLOWABLE LEVELS WERE INCREASED TO ACCOUNT FOR THE FACT THAT WE CAN'T PICK A FAN WITH, SAY, 22.8 HORSEPOWER AND HAVE THAT LISTED ON THE NAMEPLATE IN THE MOTOR. THERE ARE ALSO SOME CREDITS AVAILABLE. FOR USING SUPPLY AIR TEMPERATURES DIFFERENCES GREATER THAN 20 DEGREES FAHRENHEIT. SOME SYSTEMS USE AIR AS COLD AS 45 DEGREES F. FOR FILTRATION ABOVE ONE INCH FOR HEAT RECOVERY COILS OR DEVICES. SO YOU'RE NOT PENALIZED FOR USING THAT. WE ALSO HAVE A CREDIT FOR USING RELIEF, RATHER THAN RETURN FANS. ON YOUR SCREEN ARE THE NAMEPLATE HORSEPOWER REQUIREMENTS. NOTE THAT THEY ARE BASED ON SYSTEM SIZE AND WHETHER THE SYSTEM IS CONSTANT OR A VARIABLE VOLUME SYSTEM. AS THE SYSTEM SIZE GOES UP, THE FAN POWER GOES DOWN PER THOUSAND CFM. ALSO, VARIABLE VOLUME SYSTEMS HAVE A HIGHER POWER ALLOWANCE SINCE THAT POWER WILL DROP OFF WHEN THE SYSTEM OPERATES AT PART LOAD. THERE ARE OTHER REQUIREMENTS

FOR THE AIR HANDLING SYSTEM. FIRST, FAN MOTORS 30 HORSEPOWER AND ABOVE IN VARIABLE AIR VOLUME SYSTEMS MUST BE ABLE TO SUBSTANTIALLY REDUCE THE PART LOAD POWER CONSUMPTION. IN FACT, AT 50% CFM, AND A STATIC PRESSURE SET POINT OF ONE-THIRD OF THE DESIGN SET POINT, ONLY 30% OF THE DESIGN WATTAGE MUST BE USED, AND THIS NEEDS TO BE BASED ON MANUFACTURERS' CERTIFIED DATA. MOST PEOPLE FEEL THIS WILL LEAD TO VARIABLE FREQUENCY DRIVES ON FANS. BUT THERE ARE OTHER WAYS TO DO IT. FINALLY, FOR SYSTEMS WITH DIRECT DIGITAL CONTROL, DDC, SET POINT RESET IS REQUIRED. SOME PEOPLE REFER TO THIS AS FAN PRESSURE OPTIMIZATION. THIS MEANS THAT THE CONTROL SYSTEM MUST LOOK AT THE BOX REQUIRING THE MOST STATIC PRESSURE AND RESET THE FAN'S CONTROL POINT SO THAT THE CRITICAL BOX IS ALMOST FULLY OPEN. IN THIS WAY, THE PRESSURE THE FAN IS WORKING AGAINST IS OPTIMIZED AT EACH POINT IN TIME. FOR THOSE WHO ARE UNFAMILIAR WITH THIS SYSTEM LEVEL CONTROL STRATEGY, WE'LL SPEND A LITTLE TIME DISCUSSING IT. FAN PRESSURE OPTIMIZATION LOOKS AT ALL DAMPER OR AIR VALVE POSITIONS AND RESETS THE FAN SUPPLY STATIC PRESSURE SET POINTS TO MAINTAIN THE DAMPER NEEDING THE MOST PRESSURE AT A POINT WHERE THAT DAMPER IS 90% TO 95% OPEN. THIS MEANS THAT THE FAN IS PRODUCING JUST ENOUGH STATIC PRESSURE TO SUPPLY AIR TO THE CRITICAL ZONE, THE ONE THAT NEEDS THE MOST COOLING. IN THE MORNING, THAT CRITICAL ZONE IS LIKELY TO BE EAST FACING, WHILE IN THE AFTERNOON, IT IS PROBABLY A ZONE WITH GLASS FACING THE SOUTH OR WEST. ONE OF THE GREAT ASPECTS OF THIS CONTROL STRATEGY IS THAT SINCE THE DIRECT DIGITAL CONTROLS CONSTANTLY MONITOR DAMPER POSITION, THE SYSTEM IS DYNAMIC AND IT RESPONDS AS THE SYSTEM LOADS CHANGE. IN THIS WAY, THE FAN PRESSURE BUILDING PRODUCED IS OPTIMIZED AT ALL OPERATING POINTS AND FAN ENERGY CONSUMPTION IS DRASTICALLY REDUCED. REMEMBER THAT IT'S REQUIRED ON VARIABLE AIR VOLUME SYSTEMS THAT HAVE DIRECT DIGITAL CONTROL. >> MICK, IT LOOKS LIKE SO FAR WE'VE GONE THROUGH THE PRESCRIPTIVE REQUIREMENTS AND THEY HAVE FOCUSED ON THE AIRSIDE. YOU TALKED A LITTLE BIT ABOUT ECONOMIZER REQUIREMENTS AND AIR SYSTEM REQUIREMENTS, ALL OF WHICH, OF COURSE, HAVE A NUMBER OF EXCEPTIONS. LET'S TAKE A LOOK AT WHAT HELPS THE AIRSIDE DO ITS WORK IN THE LARGER SYSTEMS, I MIGHT ADD, DHS WATER SIDE OF THE EQUATION. >> SURE, RON. IN FACT, MY MANAGER ACTUALLY IS AN AIR GUY. AND HE CALLS ME A CHILLER-HEAD. SO I LOVE THIS PORTION OF THE PROGRAM. WE FINALLY GET TO TALK ABOUT MY STUFF. SO, LET'S MOVE FROM THE AIRSIDE TO THE CHILLED WATER SIDE OF THE BUILDING INFRASTRUCTURE. ONCE THE TOTAL PUMPING POWER REACHES 10 HORSEPOWER, VARIABLE FLOW, PUMP ISOLATION AND TEMPERATURE RESET ARE ALL REQUIRED. HOWEVER, THERE ARE EXCEPTIONS FOR EACH OF THESE THAT WE'LL DISCUSS. VARIABLE FLOW IS REQUIRED IN LARGE SYSTEMS. THIS IS TRUE WHEN THE PUMP HORSEPOWER TOTAL IN THE SYSTEM IS GREATER THAN 75 HORSEPOWER, AND THERE ARE MORE THAN THREE CONTROL VALVES. IN ADDITION, IF A SINGLE PUMP HAS GREATER THAN 100 FEET OF HEAD AND 50 HORSEPOWER, THEN IT IS REQUIRED TO BE VARIABLE FLOW. IT CAN BE CONTROLLED EITHER BY FLOW OR PRESSURE DIFFERENTIAL, AND ITS PUMPING POWER MUST BE REDUCED SUBSTANTIALLY AT PART LOAD CONDITIONS. MOST PEOPLE BELIEVE THAT THIS WILL LEAD DESIGNERS TO USE VARIABLE FREQUENCY DRIVES ON THESE PUMPS. IN ADDITION, WHEN EITHER A CHILLER OR BOILER IS SHUT DOWN, THERE MUST BE AN AUTOMATIC METHOD TO REDUCE THE SYSTEM PUMPING REQUIREMENTS. THERE IS EXCEPTION FOR CHILLERS PIPED IN SERIES. SINCE, IN SUCH CASES, THE PUMPING FLOW REMAINS CONSTANT. ADDITIONALLY, CHILLED AND HOT WATER RESET CONTROLS ARE REQUIRED, BUT NOT IF THE CONTROLS WILL CAUSE IMPROPER OPERATION OF THE SYSTEM. FOR EXAMPLE, CAUSING HUMIDITY PROBLEMS, OR FOR SYSTEMS THAT USE VARIABLE FLOW TO REDUCE THE PUMPING ENERGY. THIS MAKES SENSE, SINCE THE CHILLER ENERGY SAVED COULD EASILY BE OFFSET BY THE ADDITIONAL PUMPING POWER IN THOSE SYSTEMS. THESE VARIABLE FLOW REQUIREMENTS ARE LIKELY TO CONTINUE TO BE SATISFIED USING PRIMARY,

SECONDARY SYSTEMS. IN SUCH SYSTEMS, THERE IS A SMALL CHILLED WATER PUMP FOR EACH CHILLER. THIS IS REFERRED TO AS THE PRIMARY PUMP, WHERE THE CHILLED WATER IS BEING PRODUCED. IN THE SYSTEM, TWO-WAY VALVES REACT TO CHANGING LOADS AND RESPOND BY CLOSING, SINCE LESS WATER IS NEEDED AT LOW LOADS. THEREFORE, A VARIABLE VOLUME PUMP, USUALLY USING A VARIABLE FREQUENCY DRIVE, IS INSTALLED ON THE SECONDARY SIDE OF THE SYSTEM, AND CONTROLLED TO PROVIDE THE PRESSURE REQUIRED TO GET THE WATER TO THE "WORST CASE" COIL. THE BYPASS LINE SHOWN MAKES UP THE DIFFERENCE BETWEEN THE WATER PUMPED BY THE PRIMARY AND THE SECONDARY PUMPS. IN MY EVERYDAY JOB, I SPEND MUCH OF MY TIME WORKING WITH PEOPLE TO PUT TOGETHER CHILLED WATER SYSTEMS. OVER THE PAST THREE YEARS, I CAN TELL YOU THAT I'VE GOTTEN MORE QUESTIONS ON VARIABLE PRIMARY FLOW SYSTEMS THAN ANY OTHER SYSTEM TYPE. THIS SYSTEM ALSO MEETS THE REQUIREMENTS FOR THE VARIABLE SYSTEM FLOW. THE PUMPS ACTUALLY VARY WATER FLOW THROUGH THE CHILLER'S EVAPORATOR. THESE PUMPS CAN EITHER BE ONE PER CHILLER, OR MORE OFTEN THEY ARE MANIFOLDED TOGETHER. USUALLY, THEY HAVE VFDs ON THEM. WE DON'T HAVE A LOT OF TIME TO SPEND ON THIS TOPIC TODAY, BUT THERE ARE THREE CRITICAL ASPECTS TO ALLOW THIS SYSTEM TO WORK. FIRST, KEEP THE FLOW RATES BETWEEN THE CHILLER'S MINIMUM AND MAXIMUM FLOW LIMITS AS DEFINED BY THE MANUFACTURER. TWO, ENSURE THERE'S BYPASS IN THE SYSTEM TO SATISFY THIS REQUIREMENT. I'VE SEEN SEVERAL JOBS WHERE THEY "VALUE ENGINEERED" THE BYPASS LINE OUT OF SYSTEM AND HAVE BEEN TRYING TO CONTROL THEIR WAY OUT OF A BAD SYSTEM DESIGN FOR THE PAST FOUR YEARS. AND FINALLY, ENSURE THAT THE CHANGE OF THE FLOW RATE THE CHILLER CAN TOLERATE IS ACCOUNTED FOR IN THE SYSTEM OPERATION AND CONTROL. AS AN EXAMPLE, IF WE NEEDED TO TURN A SECOND CHILLER ON AND JUST OPEN ITS VALVE, FLOW THROUGH THE OPERATING CHILLER WOULD DROP BY 50%, AND THE FIRST CHILLER'S SAFETY CONTROLS MIGHT TURN IT OFF. CHILLERS THAT ALLOW THE FLOW RATE TO CHANGE 10% TO 30% PER MINUTE ARE CANDIDATES FOR VARIABLE PRIMARY FLOW. CHILLERS THAT CAN ONLY TOLERATE A SMALL CHANGE ARE NOT. REMEMBER THAT ALSO IN THE STANDARDS, HEAT REJECTION EQUIPMENT WAS NOT COVERED IN THE 1989 STANDARD. SO, MOVING ON TO THAT, THERE ARE NOT ONLY EFFICIENCY REQUIREMENTS FOR CONDENSERS AND COOLING TOWERS, BUT THERE ARE ALSO PRESCRIPTIVE REQUIREMENTS. ONCE THE INDIVIDUAL FAN POWER REACHES 7.5 HORSEPOWER, IT MUST HAVE THE CAPABILITY TO OPERATE AT TWO-THIRDS SPEED OR LESS. THIS IS USUALLY SATISFIED BY HAVING A TWO-SPEED MOTOR, A PONY MOTOR, WHICH IS A SEPARATE SMALL MOTOR, OR A VARIABLE FREQUENCY DRIVE ON THE FAN. THE FAN MUST HAVE AUTOMATIC CONTROLS THAT CHANGE THE FAN SPEED TO CONTROL THE LEAVING FLUID TEMPERATURE OR THE CONDENSING TEMPERATURE AND THE PRESSURE. DURING THE PUBLIC REVIEW PROCESS, A NUMBER OF EXCEPTIONS WERE ADDED TO THE STANDARD. THEY INCLUDE THE CASE WHERE THE CONDENSER FANS ARE ON A MULTIPLE REFRIGERANT CIRCUITS. OR WHERE A FLOODED CONDENSER IS BEING USED TO ALLOW THE UNIT TO OPERATE IN VERY LOW AMBIENT CONDITIONS. ALSO IN CLIMATES SUCH AS THOSE FOUND IN FLORIDA, WHERE THERE IS A LOT OF COOLING. AND THE CASE WHERE WE HAVE MULTIPLE FANS. IF WE HAVE THREE FANS, WE MUST HAVE SOME WAY OF REDUCING THE FAN SPEED ON AT LEAST TWO OF THOSE FANS. SO, WHAT IS THE DRIVER FOR ALL THIS? PART SPEED FAN OPERATION ON TOWERS ALLOWS THE SYSTEM TO BE RUN AT THE COOLING LOWER SET POINT TO MINIMIZE THE SUM OF CHILLER PLUS TOWER FAN ENERGY. THERE ARE AT LEAST THREE CONTROL PROVIDERS WHO HAVE FOUND THIS RELATIONSHIP. HERE WE SHOW A DIAGRAM FROM HYDEMAN, GILLESPIE AND KAMMERUD, WHO PUBLISHED A PAPER IN SEPTEMBER, 1997, SHOWING THE OPTIMAL CONDITION OR A CHILLER-TOWER CHANGES WITH LOAD AND WET BULB. THIS PAPER WAS FIRST PRESENTED AT THE NATIONAL FORUM IN SAN FRANCISCO. AS THE LOAD AND WET BULB CHANGE, THE POINT AT WHICH THE MINIMUM SYSTEM ENERGY OCCURS CHANGES ALSO. HAVING A VARIABLE FREQUENCY DRIVE ON THE

TOWER FANS ALLOWS THE CONTROL SYSTEM TO FIND THIS POINT AND REDUCE SYSTEM OPERATING COSTS. ANOTHER MAJOR ADDITION TO THE STANDARD IS THAT HEAT RECOVERY IS REQUIRED IN SEVERAL SITUATIONS. FIRST, LET'S LOOK AT THE AIRSIDE. HEAT RECOVERY WITH 50% EFFECTIVENESS IS REQUIRED ON THE AIRSIDE WHEN INDIVIDUAL FAN SYSTEMS HAVE 5,000 CFM AND IT'S 70% OUTSIDE AIR OR MORE. NOTE THAT THE EFFECTIVENESS IS TOTAL ENERGY TRANSFER, NOT JUST SENSIBLE. THERE ARE NINE EXCEPTIONS FOR THIS IN THE STANDARD. THE MAJOR EXCEPTIONS INCLUDE SYSTEMS EXHAUSTING TOXIC, FLAMMABLE, PAINT OR CORROSIVE FUMES OR DUST. THAT'S A GOOD ONE. FIRST, THEN IF 60% OF THE OUTDOOR HEATING ENERGY IS FROM THE SITE-RECOVERED OR SITE-SOLAR ENERGY. AGAIN, THIS IS WHERE HEAT FROM A CONDENSER OF A DIRECT EXPANSION SYSTEM OR CONDENSER WATER LOOP CAN BE USED TO HEAT THE OUTDOOR AIR. SINCE THE COMMITTEE ALSO CONSIDERED IMPLEMENTATION OF THE STANDARD, THERE ARE TIMES WHEN THERE WILL BE MANY INDIVIDUAL EXHAUSTS IN THE BUILDING. IN SUCH A CASE, IT IS NOT ECONOMICAL TO PIPE ALL THAT ENERGY BACK TO THE OUTSIDE AIR STREAM, SO THERE IS AN EXCEPTION IF THERE ISN'T A SINGLE EXHAUST AIR STREAM OF AT LEAST 75% OF THE AIRFLOW OF THE OUTSIDE AIRFLOW. IN THE CASE OF A 5,000 CFM SYSTEM, WE'D HAVE TO BE EXHAUSTING AT LEAST 3,750 CFM FROM A SINGLE LOCATION BEFORE ENERGY RECOVERY IS REQUIRED. ANOTHER EXCEPTION IS WHERE SYSTEM DEHUMIDIFICATION EMPLOYS A SERIES-STYLE ENERGY RECOVERY COILS WRAPPED AROUND THE MECHANICAL COOLING COIL. LET'S LOOK AT THIS CONFIGURATION. HERE THE OUTSIDE AIR COMES IN AND PASSES THROUGH A PRECONDITIONING COIL. DURING THE SUMMER, THIS REDUCES THE AIR TEMPERATURE. THE AIR IS THEN DEHUMIDIFIED BY A COOLING COIL. FINALLY, IT PASSES THROUGH ANOTHER COIL THAT BRINGS THE TEMPERATURE BACK UP TO A POINT SO THAT THE SPACE DOESN'T SUB COOL. THE SAME AMOUNT OF HEAT THAT WAS TAKEN OUT OF THE INCOMING AIR STREAM IS NOW ADDED BACK. OFTEN, THIS CONFIGURATION CAN BE ACCOMPLISHED USING TWO COILS AND A SMALL PUMP OR PERHAPS A HEAT PIPE. SYSTEM OUTSIDE AIR ENERGY RECOVERY WOULD GREATLY REDUCE THE EFFECTIVENESS OF THIS SERIES ENERGY RECOVERY STRATEGY, THUS THE EXCEPTION. TODAY, THE MOST POPULAR TOTAL RECOVERY DEVICE IS A TOTAL ENERGY WHEEL. THE WHEEL ON THIS SLIDE IS INSTALLED IN AN INDOOR UNIT. IT COULD BE AN OUTDOOR UNIT, TOO. THE TOTAL ENERGY ROTARY WHEELS GO BY MANY DIFFERENT NAMES. THEY'RE ALSO CALLED ENTHALPY WHEELS, HEAT WHEELS, ENERGY WHEELS OR EVEN DESICCANT WHEELS. I PERSONALLY TRY TO STAY AWAY FROM THE WORD "DESICCANT" FOR THIS TECHNOLOGY, SINCE IT COULD BE CONFUSED WITH AN ACTIVE DESICCANT SYSTEM. ANOTHER TECHNOLOGY USED IS A MEMBRANE FIXED-PLATE HEAT EXCHANGER. THE MEMBRANE EXCHANGERS ARE SHAPED LIKE A FIXED PLATE HEAT EXCHANGER, BUT THEY'RE MADE OF A PAPER-LIKE MATERIAL. THIS MATERIAL IS A MEMBRANE THAT ALLOWS MOISTURE TO TRANSFER FROM ONE AIR STREAM TO THE OTHER. THAT'S THE AIRSIDE. PROVIDING ENERGY RECOVERY FOR SERVICE WATER HEATING IS ALSO ADDRESSED. WHEN THE FACILITY OPERATING 24 HOURS A DAY HAS A TOTAL INSTALLED HEAT REJECTION OF 6 MILLION BTUs PER HOUR, AND HAS A DESIGN SERVICE WATER HEATING LOAD GREATER THAN 1 MILLION BTUs PER HOUR, THEN IT MUST HAVE ENERGY RECOVERY. THE ENERGY RECOVERY NEEDS TO BE SIZED FOR THE SMALLER OF 60% OF THE PEAK HEAT REJECTION, LOAD AT DESIGN CONDITIONS, OR TO PREHEAT THE PEAK SERVICE HOT WATER DRAW TO 85 DEGREES FAHRENHEIT. A POSSIBLE APPLICATION FOR THIS IS A HOSPITAL, A DORMITORY, ET CETERA. NOW, LET'S TALK ABOUT HOW YOU MIGHT WANT TO PIPE A CHILLER INTO THE SYSTEM TO ALLOW THIS. PLEASE UNDERSTAND THAT WHILE ENERGY RECOVERY IS PART OF THE STANDARD, WHAT WE'RE ABOUT TO DISCUSS ARE SIMPLY OPTIONS TO ACHIEVE THAT ENERGY RECOVERY. AS IN THE CASE WITH THE SIMULTANEOUS HEATING AND COOLING, CONSIDER PUTTING THE HEAT RECOVERY CHILLER IN A LOCATION WHERE IT CAN BE PREFERENTIALLY LOADED. EARLIER IN THE BROADCAST, WE LOOKED AT THE SIDE STREAM LOCATION. ONE DRAWBACK WITH THAT CONFIGURATION IS THAT THE CHILLED WATER PUMP

DOES NOT HELP PUMP WATER THROUGH THE SYSTEM, BUT MERELY CIRCULATES IT THROUGH THE CHILLER AND REDUCES THE RETURN WATER TEMPERATURE. ANOTHER POSSIBLE PREFERENTIAL LOADING OPTION IS TO PUT THE CHILLER ON THE LOAD SIDE OF THE BYPASS LINE. IN THIS POSITION, IT SEES THE WARMEST RETURN WATER TEMPERATURE, AND THEREFORE IS PREFERENTIALLY LOADED, ALLOWING US TO RECOVER MORE HEAT. ALSO IN THE REQUIREMENTS ARE STANDARDS FOR EXHAUST HOODS. KITCHEN HOODS OF ABOUT 5,000 CFM REQUIRE 50% MAKEUP AIR THAT IS UNTREATED OR ONLY HEATED TO 60 DEGREES FAHRENHEIT, AND UN-COOLED OR COOLED WITHOUT MECHANICAL COOLING. ONCE A FUME HOOD HAS MORE THAN 15,000 CFM OF AIRFLOW, IT IS REQUIRED TO HAVE ONE OF THE FOLLOWING. THE CAPABILITY TO REDUCE EXHAUST AND AIR AND MAKEUP AIR VOLUME TO 50% OR LESS OF DESIGN VALUES. A DIRECT MAKEUP AIR SUPPLY OF AT LEAST 75% OF THE EXHAUST RATE, AT LEAST TWO DEGREES FAHRENHEIT BELOW THE ROOM SET POINT, IF IT'S IN THE HEATING MODE, AND THREE DEGREES F ABOVE THE ROOM SET POINT IF IT'S IN THE COOLING MODE. IT CANNOT HAVE HUMIDIFICATION ADDED OR SIMULTANEOUS HEATING AND COOLING FOR THE DEHUMIDIFICATION CONTROL. A THIRD EXCEPTION IS THAT IT USES AN ENERGY RECOVERY SYSTEM IN ACCORDANCE WITH THE EXHAUST AIR ENERGY RECOVERY SYSTEM. ANOTHER REQUIREMENT IS FOR OUTDOOR USES. THERE, RADIANT HEATING IS REQUIRED. THAT MAKES A LOT OF SENSE. IF YOU'RE SITTING OUTSIDE, YOU GET THE RADIANT HEATING RATHER THAN THE HOT AIR BEING BLOWN AROUND. THERE'S ALSO LIMITATIONS ON HOT GAS BYPASS, NOT HOT GAS REHEAT, BUT BYPASS. HOT GAS BYPASS IS GENERALLY USED TO KEEP A COMPRESSOR FROM CYCLING AND IS VERY ENERGY INEFFICIENT. IT APPLIES TO SYSTEMS OVER 7.5 TONS AND THE LIMITS OF 50% IF THE UNIT IS 20 TONS OR LESS. FOR UNITS OVER 20 TONS, THE LIMIT IS 25%. MOST PEOPLE THINK OF HOT GAS BYPASS WITH RESPECT TO DIRECT EXPANSION SYSTEMS, BUT IT'S IMPORTANT TO UNDERSTAND THAT THIS LIMIT ALSO APPLIES TO CHILLERS. IN THE SERVICE WATER HEATING SECTION, THERE IS AN EQUIPMENT EFFICIENCY TABLE. PIPING INSULATION REQUIREMENTS, AND SYSTEM CONTROLS FOR TEMPERATURES AND THE CIRCULATING PUMPS. THERE ARE ALSO REQUIREMENTS FOR POOL HEATERS, COVERS, AND FOR TIME SWITCHES. THERE'S ALSO A PRESCRIPTIVE REQUIREMENT FOR THE STANDBY LOSS FOR SPACE AND WATER HEATING, AS WELL AS A REQUIREMENT THAT A PIECE OF EQUIPMENT THAT IS USED FOR SPACE AND WATER HEATING NEEDS TO MEET ALL THE REQUIREMENTS FOR THE SERVICE WATER HEATING EQUIPMENT. >> OKAY. GREAT, MICK. THANKS A LOT. >> YOU BET. >> WE'RE READY FOR QUESTIONS. ON YOUR SCREEN, YOU SHOULD SEE THE CALL-IN NUMBERS, AS WELL AS THE FAX NUMBERS. I SEE WE HAVE SOMEBODY IN OUR STUDIO AUDIENCE THAT WOULD LIKE TO POSE A QUESTION. GO AHEAD, TRACY. >> MICK, IN CONSTANT VOLUME REHEAT SYSTEMS THAT EXIST, CAN YOU REZONE OR REASSIGN ZONES AND REDISTRICT THEM WITHOUT UPGRADING TO THE NEW STANDARDS? >> WELL, THAT'S A GREAT QUESTION. AND ONE OF THE THINGS WE DIDN'T COVER IN THIS PORTION RIGHT NOW IS HOW THIS ACTUALLY, THIS STANDARD APPLIES TO EXISTING SYSTEMS. IN AN EXISTING SYSTEM, THINK OF IT AS THE PORTION OF THE SYSTEM THAT'S CHANGING NEEDS TO BE BROUGHT UP TO COMPLIANCE. FOR EXAMPLE, IN THE CASE OF A PIECE OF EQUIPMENT IF YOU'RE REPLACING IT, THAT NEEDS TO BE IN COMPLIANCE WITH THE NEW STANDARD REQUIREMENTS. HOWEVER, IN YOUR QUESTION, TRACY, IF WE HAVE A SYSTEM THAT ISN'T BEING CHANGED, IT'S A CONSTANT VOLUME SYSTEM, OR JUST MOVING A SMALL PORTION OF THE SYSTEM FOR THE SPACE REQUIREMENT, THEN YOU PROBABLY DON'T NEED TO BE, TO BRING IT UP TO THE NEW REQUIREMENTS IN THE STANDARD. HOWEVER, LET'S SAY I'M GOING INTO AN EXISTING BUILDING AND GUTTING THE ENTIRE BUILDING. THEN, WE CAN PUT IN THE NEW DUCTWORK, PUT IN THE NEW PIPING AND INSULATION. SO, IN THAT CASE, IN AN EXISTING BUILDING, THE ENTIRE SYSTEM WOULD HAVE TO BE BROUGHT UP TO COMPLIANCE. >> OKAY. I BELIEVE WE HAVE A CALL-IN QUESTION NOW. GO AHEAD, CALLER. >> I HAVE A QUESTION ABOUT DISPLACEMENT AIR SYSTEMS AND IN RESPECT TO FAN PRESSURIZATION. IF YOU, IN

FACT, YOU HAVE 20% OF YOUR TERMINALS IN THE DISPLACEMENT SYSTEMS THAT ARE CONTROLLED BY DDC, AND THE 80% ARE LEFT BACK TO MANUAL CONTROL, WHICH SEEMS TO BE THE PREDOMINANT WAY OF DOING THINGS IN EUROPE AND JAPAN NOW, HOW WOULD THAT STANDARD APPLY? >> THAT'S A GOOD QUESTION. AND BASICALLY, THE QUESTION FOR THE STUDIO AUDIENCE IS, IF THERE'S A DISPLACEMENT VENTILATION SYSTEM, SOME OF THE CONTROLS ARE DDC CONTROLLED, DIRECT DIGITAL CONTROLS. OTHERS ARE MANUALLY CONTROLLED. I BELIEVE IT WAS THE COMMITTEE'S INTENT TO REDUCE THE PRESSURE WHEN THE ENTIRE SYSTEM WAS DDC CONTROLLED. IT'S NOT REQUIRED FOR PNEUMATICALLY CONTROLLED SYSTEMS. SO, WHILE I CAN'T GIVE THE COMMITTEE'S OFFICIAL INTERPRETATION, IT HAS TO COME THROUGH ASHRAE, I WOULD THINK, PUTTING MY DESIGNER'S HAT ON, THAT IT WOULD BE REQUIRED IF THE SYSTEM CONTROL WAS ENTIRELY DDC. >> OKAY. WE'VE GOT A COUPLE OF FAX QUESTIONS HERE. THE FIRST ONE, THIS IS FROM KAY THRASHER DOWN IN CHATTANOOGA, HAS 90.1, 2001, BEEN ADOPTED BY SBCCI OR THE INTERNATIONAL BUILDING CODE? >> WOW. >> THE CODE PROCESSES DON'T WORK QUITE THAT FAST, KAY. I WISH IT WOULD. HOWEVER, I CAN SAY THAT I BELIEVE IT'S ASHRAE'S INTENTION THAT THE CODE HEARINGS TO SUBMIT THE 2001 VERSION FOR CONSIDERATION BY THE IECC. >> CAN I GET IN ON THAT, RON? ANOTHER THING THAT I'D LIKE TO SAY IS THAT ALTHOUGH THE 2000 VERSION OF THE INTERNATIONAL CODE DOESN'T INCLUDE IT, AND IT REFERS TO THE IECC 2000, THE 2001 SUPPLEMENT OF THE INTERNATIONAL ENERGY CONSERVATION CODE ACTUALLY DOES POINT TO ASHRAE STANDARD 90.1, 1999. AND THAT'S SOMETHING. SO, WHEN YOU'RE GOING, WORKING WITH STATE CODE OFFICIALS, I'VE LEARNED A LOT ABOUT CODES THAT I DIDN'T KNOW BEFORE, YOU NEED TO KNOW WHICH VERSION THAT THEY'RE TAKING. ARE THEY TAKING A 2000 VERSION? ARE THEY TAKING THE 2001 SUPPLEMENT? IN TALKING WITH STATE CODE OFFICIALS, SOME HAVE ADOPTED 2001 SUPPLEMENTS BUT THE REST OF THE IECC CODE FROM 2000. >> RIGHT. GOOD POINT, MICK. THE SECOND QUESTION IS, FROM KAY IS, THE EER LISTED FOR WATER SOURCE HEAT PUMPS USING THE OLDER ARI STANDARD OR THE NEW ISO STANDARD? >> THAT'S A GREAT QUESTION. I THINK I PUT ON THE SLIDE, I THINK IT WAS THE NEW STANDARD. THAT WAS SIMILAR TO WHAT HAPPENED WITH ADDENDUM J WITH THE CHILLERS. ARI REVISED THE STANDARD, 13256 OR SOMETHING LIKE THAT, IN THE NEW ISO STANDARD. IMMEDIATELY AFTER THE 1999 PUBLICATION, THIS ASHRAE 90.1
COMMITTEE SENT OUT AN ADDENDUM PUBLIC REVIEW TO GO TO THE NEW ISO STANDARD. SO, THE EQUIPMENT STANDARDS FOR HEAT PUMPS ARE IN THE ADDENDUM THAT HAVE BEEN SENT OUT AND ARE AVAILABLE ON THE ASHRAE WEBSITE. THEY WERE NOT IN THE ORIGINAL 1999 STANDARD. THAT WAS UNDER THE OLD STANDARD. BUT ALL THE NEW ONES ARE WITH THE NEW 13256 STANDARD. >> AND I MIGHT QUICKLY REMIND THE LISTENERS THAT THE NEW 2001 PRINTING OF STANDARD 90.1 IS AVAILABLE, AND ALL OF THE ADDENDA THAT HAVE BEEN APPROVED BY THE BOARD ARE INCLUDED INTO THIS NEW PUBLICATION. SO IF YOU GET THIS ONE, YOU'LL FIND ALL OF THE UPDATED INFORMATION. LET'S GO TO OUR AUDIENCE NOW. DO YOU HAVE A QUESTION, SIR? >> YES. MICK, ON CHILLERS, YOU LISTED A 0.567 kW/TON. IS THAT THE ONLY POINT THAT CENTRIFUGAL CHILLERS CAN MEET, OR ARE THERE OTHER POINTS THAT CENTRIFUGAL CHILLERS ARE ALLOWED TO? >> THAT'S A REALLY GOOD QUESTION. BASICALLY, CENTRIFUGAL CHILLERS ARE DIFFERENT THAN OTHER CHILLERS. AND THAT IS, FOR EXAMPLE, A SCROLL CHILLER, IT DOESN'T CHANGE ITS EFFICIENCY WHEN YOU CHANGE THE, OR ITS DESIGN WHEN YOU CHANGE THE TEMPERATURES IT'S WORKING AGAINST. WHEREAS CENTRIFUGAL CHILLERS, TO BE OPTIMALLY SELECTED, IF YOU REDUCE THE WATER TEMPERATURE 44 DEGREES, 85 DEGREES ENTERING THE CONDENSER AND 3 GPM PER TON. IF YOU CHANGE THE CHILLED WATER TEMPERATURE, SAY, TO 40 DEGREES, OR DECREASE THE FLOW RATE ON THE CONDENSER WATER SIDE, TO SELECT THE CHILLER, YOU'LL PICK A CHILLER WITH A DIFFERENT IMPELLER TO GIVE YOU THAT GREATER PRESSURE LIFT. THERE ARE ACTUALLY TABLES WITHIN THE STANDARD THAT

CORRECT THE STANDARD CONDITIONS TO YOUR OPERATING CONDITIONS DOWN TO 40 DEGREES F ON THE CHILL WATER SIDE, DOWN TO, I THINK IT'S 1.5 GPM PER TON ON THE WATER CONDENSER SIDE, AND THERE ARE ACTUALLY TABLES. SO YOU LOOK AT THAT TABLE AND THERE'S AN EQUATION. IF YOU'RE AN EQUATION KIND OF PERSON, YOU CAN PUT IT INTO A SPREAD SHEET AND DO THE CALCULATION THAT WAS DONE FOR YOU IN THE TABLE. BUT, FOR NONSTANDARD CONDITIONS, CHILLERS HAVE AN ENTIRE, THREE ENTIRE TABLES THAT WILL GIVE YOU BOTH THE FULL LOAD kW/TON AND THE MPLV REQUIREMENTS. >> OKAY. WE HAVE A BIG STACK HERE. SO, LET'S SEE WHAT WE CAN DO. >> I'LL GO SHORTER. >> OKAY, IF YOU CAN. REGARDING THE MANDATORY REQUIREMENTS IN THE 90-DAY REQUIREMENT FOR PROVIDING DOCUMENTATION, WHAT HAPPENS IF THEY DON'T GET THE DOCUMENTATION UNTIL LATER THAN 90 DAYS? >> OBVIOUSLY, THE 90 DAYS IS THERE TO REALLY ENCOURAGE PEOPLE TO GET THE DOCUMENTATION TO THE BUILDING OWNER AND THE OPERATOR. COULD SOMEBODY ENFORCE THAT AND CAUSE YOU A PROBLEM? THE ANSWER IS, YES. BUT WHAT WE WANT TO DO, WE WANT TO MAKE SURE THAT THE ENERGY GETS SAVED BY PEOPLE KNOWING HOW YOU INTENDED THE SYSTEM TO OPERATE. >> OKAY. HERE'S ANOTHER QUESTION FROM BILL, IN UP IN VERMONT. CAN I USE A CO2-DRIVEN VENTILATION SYSTEM IN LIEU OF ENERGY RECOVERY, EVEN IF I HAVE GREATER THAN 3,000 CFM OUTSIDE AIR? AND HE GIVES AN EXAMPLE OF WHERE HE BELIEVES THIS MIGHT BE USEFUL. THE SCHOOL GYM OR AUDITORIUM WHERE ONLY 30 STUDENTS WOULD BE THERE MOST OF THE TIME, BUT AS MANY AS 300 TO 1,000 FOR SHORT PERIODS OF ASSEMBLY. >> I DON'T REMEMBER. I MEAN, TO BE TRUTHFUL WITH YOU. THERE ARE A NUMBER OF EXCEPTIONS TO THE ENERGY REQUIREMENTS. I DON'T REMEMBER RIGHT OFFHAND IF THE SENSOR IS ONE OF THEM. WE CAN CHECK IN THAT SECTION OF THE STANDARD. >> OKAY. WE'LL TRY TO SEE IF WE CAN FIND AN ANSWER FOR YOU, BILL. BUT YOU MIGHT WANT TO CHECK THE STANDARD YOURSELF. OKAY. HERE'S ANOTHER ONE FROM YOUR COLLEAGUES HERE AT ONE OF THE SITES. FIRST QUESTION. ARE ROOFTOP MULTI-ZONE UNITS ALLOWED UNDER THE NEW STANDARD? >> THAT, ONCE AGAIN, IS A GOOD QUESTION. GOING BACK TO HOW THE STANDARD APPLIES TO EXISTING EQUIPMENT. EXISTING EQUIPMENT CAN BE REPLACED ON A LIKE-FOR-LIKE BASIS. IF THERE'S ALREADY A ROOFTOP PACKAGED PIECE OF EQUIPMENT THERE, IT CAN BE REPLACED WITH ANOTHER ROOFTOP MULTI-ZONE PIECE OF EQUIPMENT. HOWEVER, IF YOU'RE DESIGNING AN ENTIRELY NEW SYSTEM, IT WOULD BE TOUGH TO COMPLY WITH THE, ALMOST IMPOSSIBLE TO COMPLY WITH THE HEATING REQUIREMENT IN THE ECONOMIZER SECTION WITH A MULTI-ZONE SYSTEM. >> A SECOND QUESTION FROM THE SAME CALLER. ARE TRIPLE DECK MULTI-ZONE SYSTEMS ALLOWED WHERE THEY'RE HOT, COLD OR RETURNED OR AN ECONOMIZER IN ANY TWO ARE PERMITTED TO MIX? >> AND THE ANSWER TO THAT WOULD BE, YES, AS LONG AS YOU DIDN'T HAVE SIMULTANEOUS HEATING AND COOLING GOING ON. WHEN YOU USE THE RETURN AIR TO DO THE HEATING OR THE TEMPERING OF THE AIR, THEN YOU AREN'T REALLY CONCERNED ABOUT ADDING NEW ENERGY TO THAT AIR. THERE IS JUST THE RETURN AIR WILL BE CLOSE TO WHAT WAS IN THE SPACE. SO, I WOULD SAY THAT A THREE-DECK MULTI-ZONE USING ONLY THE BYPASS AIR SHOULD MEET THE REQUIREMENTS. >> OKAY. GREAT. NOW, FROM KEN DOWN IN TUCSON, FOR THE SIMPLIFIED APPROACH, PLEASE ELABORATE ON THE SINGLE HVAC ZONE. IF I HAVE A 5,000-SQUARE-FOOT BUILDING WITH TWO AIR CONDITIONING UNITS AND THERMOSTATS, IS THIS TWO ZONES OR SINGLE HVAC ZONE? >> OKAY. THAT'S A REAL GOOD QUESTION. A SYSTEM IS DEFINED AS THE AIR HANDLING EQUIPMENT THAT NEEDS TO BRING THE AIR FROM THE OUTDOORS, CONDITION IT TO THE SPACE, AND GET IT BACK TO THE OUTDOORS. SO, THAT ENTIRE AIRSIDE SYSTEM. SO, TWO ROOFTOPS WOULD BE TWO SEPARATE SYSTEMS. SO, IN THAT CASE, YOU HAVE TWO SEPARATE SYSTEMS. AND EACH WOULD HAVE TO SERVE A SEPARATE THERMAL ZONE WITHIN THAT BUILDING. >> OKAY, GREAT. THANKS. HERE'S ONE FROM WALTER DOWN IN PHOENIX. IS THE SEPARATE COOLING TOWER REQUIRED FOR WATERSIDE ECONOMIZER? FOR SIMULTANEOUS CHILLER AND ECONOMIZER OPERATION, DOES

THE CHILLER HAVE TO BE DESIGNED FOR LOW TEMPERATURE CONDENSER WATER? >> THAT'S ANOTHER REAL GOOD APPLICATION QUESTION. FIRST OF ALL, THE WATERSIDE ECONOMIZER DOES NOT MAKE YOU HAVE A SEPARATE COOLING TOWER. YOU CAN USE THE SAME COOLING TOWER, AND I KNOW THAT YOU USE A LOT OF THEM DOWN IN THE SOUTHWEST. SECONDLY, THE CHILLER, THE CHILLED WATER, THE CONDENSER WATER SYSTEM NEEDS TO BE DESIGNED SO THAT YOU CAN USE THE COLD WATER COMING FROM THE COOLING TOWER AND THROUGH THE ECONOMIZER. IN THE MANUAL, IT SHOWS A GREAT EXAMPLE OF A BYPASS ARRANGEMENT WHERE THE WATER FIRST GOES THROUGH THE WATERSIDE ECONOMIZER, AND THEN A PORTION OF IT GOES THROUGH THE CHILLER'S CONDENSER, BECAUSE ANY CHILLER NEEDS TO HAVE A PRESSURE DIFFERENTIAL TO OPERATE. OURS, ANYBODY'S, HAS TO HAVE THAT PRESSURE DIFFERENTIAL. SO, THERE NEEDS TO BE SOMETHING IN THE SYSTEM SO THAT YOU CAN OPERATE THE ECONOMIZER AND THE CHILLER SIMULTANEOUSLY. >> GOOD QUESTION. >> OKAY. WE'RE TRYING TO WORK OUR WAY THROUGH THESE THINGS. WE HAVE AN EMBARRASSMENT OF RICHES OF QUESTIONS HERE, SO WE WON'T GET TO ALL OF THEM, UNFORTUNATELY. BUT WE'LL DO OUR BEST. HERE'S A QUESTION FROM SALT LAKE CITY. HOW WILL ASHRAE 90.1 COMPLIANCE BE MONITORED ON EQUIPMENT SUCH AS ROOFTOPS AND CHILLERS WHEN DESIGN CONDITIONS ARE THOSE OTHER THAN STANDARD ARI? >> ESPECIALLY FOR THE PACKAGED EQUIPMENT, HOW THAT EQUIPMENT IS APPLIED IN THE SYSTEM IN WHICH IT IS APPLIED DOESN'T REALLY CHANGE ITS EFFICIENCY. IT STILL HAS THE SAME MOTOR, THE SAME HEAT EXCHANGERS, ET CETERA. THEREFORE, THAT EQUIPMENT COMPLIANCE IS GOING TO BE BASED ON THE ARI STANDARD CONDITIONS. YOU, AS A DESIGNER, THINK AND TAKE THAT EQUIPMENT AND PUT IT INTO THE SYSTEM AND USE IT FOR YOUR APPLICATION REQUIREMENTS AS LONG AS IT MEETS THE ARI STANDARD RATING CONDITIONS. THE EXCEPTION FOR THAT IS CENTRIFUGAL CHILLERS. ONCE YOU GET AWAY FROM THE STANDARD RATING CONDITIONS, THERE ARE SEPARATE TABLES FOR THOSE. >> HERE'S ANOTHER QUESTION. THIS IS FROM LOS ANGELES. THERE ARE THREE UNITS THAT IS MEASURE EQUIPMENT EFFICIENCIES AT PEAK LOAD. COP, EER, AND kW/TON. WHY DOES THE STANDARD NOT USE ONLY ONE OF THESE? DOES IT MAKE ANY DIFFERENCE, EXCEPT THEIR HISTORICAL USAGE? >> THAT'S A GOOD QUESTION. FIRST OF ALL, YOU WON'T FIND kW/TON IN THE STANDARD. AND THE REASON IS, ONE OF THE THINGS THAT THE ASHRAE BOARD OF DIRECTORS DIRECTED OUR COMMITTEE TO DO IS TO MAKE SURE THIS COULD BE IMPLEMENTED INTERNATIONALLY. THE INTERNATIONAL UNITS ARE COP, CO-EFFICIENT OF PERFORMANCE. THERE ARE SOME UNIT RATING STANDARDS THAT ARE COP AND OTHERS THAT ARE EER, ENERGY EFFICIENCY RATIO. WHAT THE COMMITTEE TRIED TO DO IS GO TO THOSE RATING STANDARDS AND FOR EACH STANDARD, DECIDE, LOOK AT IT AND SEE IF YOU USE COP, THAT'S WHAT WE'RE GOING TO REQUIRE. IF IT USES EER, THAT'S WHAT WE'RE GOING TO REQUIRE WITHIN THE STANDARD. >> OKAY. ONE MORE HERE. LET'S SEE. HOW DOES THE STANDARD ADDRESS IAQ IN THE BUILDING WHERE THE AIR ECONOMIZER IS NOT USED AND, THEREFORE, THE BUILDING IS NEVER PURGED? >> OKAY. REALLY, STANDARD 90.1 IS AN ENERGY STANDARD. WHILE WE USE AND HAD PEOPLE FROM STANDARD 62 ON THE COMMITTEE, A PERSON WAS

ACTUALLY CHAIR OF STANDARD 62. SO WE KNEW WHAT WAS GOING ON THERE. WE TRIED TO INTEGRATE EVERYTHING. BUT INDOOR AIR QUALITY IS SATISFIED BY THE VENTILATION REQUIREMENTS IN STANDARD 62. SO WE'D HAVE TO LOOK THE STANDARD 62 FOLKS TO HELP US WITH THAT ONE. >> OKAY. THANKS A LOT, MICK. MY APOLOGIES TO ALL THE PEOPLE THAT FAXED IN QUESTIONS THAT WE WEREN'T ABLE TO GET TO. IF WE WERE ABLE TO IDENTIFY WHERE THESE CAME FROM, WE'LL MAKE AN ATTEMPT TO GET SOME ANSWERS SUBSEQUENT TO THE BROADCAST. NOW, I'D LIKE TO WRAP THINGS UP FOR THIS SEGMENT. FIRST, STARTING OFF WITH WHERE YOU CAN GET THE STANDARD SHOULD BE APPEARING ON YOUR SCREEN, A GRAPHIC, INDICATING THE ASHRAE LOCATION, BOTH THE WEBSITE AS WELL AS THE PHONE NUMBERS. SO, PLEASE USE THE WEB OR USE THE PHONE TO GET YOUR COPY OF THE STANDARD. AND REMEMBER TO ASK FOR THE NEW 2001 PRINTING, WHICH INCLUDES ALL OF THE APPROVED ADDENDA. I'D LIKE TO THANK EVERYONE, BOTH HERE IN THE STUDIO AUDIENCE WITH THE INLAND EMPIRE CHAPTER, AND ACROSS THE COUNTRY, FOR JOINING US. WE HOPE YOU'LL BE BACK FOR OUR LAST SEGMENT, WHICH WILL BE COMING UP. ALSO WANT TO LET YOU KNOW THAT IF WE HAVEN'T PROVIDED THE DETAIL THAT YOU WANTED AND YOU STILL WANT MORE, THERE WILL BE AN OPPORTUNITY WITH THE ASHRAE PROFESSIONAL DEVELOPMENT SEMINARS. AND THE FIRST ONE OF THOSE SEMINARS WILL BE OFFERED ON JANUARY 11th AND 12th AT THE ATLANTIC CITY MEETING. THERE ARE TWO SUBSEQUENT SEMINARS THAT ARE TENTATIVELY SCHEDULED, ONE FOR MAY 15th AND 16th IN ST. LOUIS, AND ONE FOR NOVEMBER 20th AND 21st IN BALTIMORE. CHECK THE ASHRAE WEBSITE FOR AN UPDATE ON THAT. NOW, WE'LL BE BACK WITH THE LIGHTING PRESENTATION AT 3:00 EASTERN TIME. I ENCOURAGE EVERYONE TO JOIN US FOR THAT PRESENTATION. AND THANKS A LOT FOR YOUR ATTENDANCE. OH, YES. I FORGOT TO MENTION SIGN-IN SHEETS AND EVALUATION FORMS. EACH OF THE SITES AROUND THE COUNTRY SHOULD HAVE COPIES OF SIGN-IN SHEETS AND EVALUATION FORMS. PLEASE SUBMIT THOSE BACK TO US. THIS IS VERY IMPORTANT FOR BOTH OUR SPONSORS, AS WELL AS OUR OWN QUALITY ASSURANCE. IN FACT, IT'S HOW WE KNOW THAT YOU'RE OUT THERE. SO YOU SIGNED UP ON THE WEBSITE, PLEASE FOLLOW THROUGH AND GET THOSE THINGS TO US SO THAT WE CAN REPORT THE SUCCESS OF THIS EVENT. AND, AGAIN, THANKS A LOT FOR BEING WITH US, AND WE'LL SEE YOU AT 3:00 EASTERN TIME._